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# MODERN

# MATERIA MEDICA

AND

# THERAPEUTICS

BY

**A. A. STEVENS, A.M., M.D.**

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Fifth Edition, Thoroughly Revised

In Conformity with the Eighth Revision (1905) of the United States Pharmacopoeia

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# PREFACE TO THE FIFTH EDITION.

THIS edition has been thoroughly revised, and contains many important modifications and considerable additions. The section dealing with the Action and Uses of Drugs has been in large part rewritten. Articles dealing with a number of new remedies have been incorporated, and new formulæ have been added where it was thought they would make more clear the therapeutic application of the drugs under consideration. The author ventures to hope that the work in its present form may be found equal to existing requirements, and that it may prove as acceptable to students of medicine as former editions.

314 S. Sixteenth Street, PHILADELPHIA,

*August*, 1909.



G5771

# PREFACE TO THE FOURTH EDITION.

THE fourth edition of this work has been thoroughly revised and adapted to the Eighth Decennial Revision of the *United States Pharmacopœia*. Such corrections and additions have been made as seemed necessary to make it a more complete guide to the study of Materia Medica and Therapeutics. New articles, dealing with Scopolamin, Ethyl-chlorid, Theocin, Veronal, and Radium have been introduced, and in the section on Radiotherapy much new matter has been incorporated.

Among the many changes to be found in the new Pharmacopœia, attention is especially called to the following: The tincture of aconite has been reduced in strength from 35 per cent. to 10 per cent., and the tincture of veratrum from 40 per cent. to 10 per cent. The tinctures of strophanthus and cantharides have each been increased in strength from 5 per cent. to 10 per cent. The tincture of nux vomica now contains 0.1 per cent. instead of 0.3 per cent. of strychnin.

Blue ointment and mercurial ointment are no longer synonymous. The former (Unguentum Hydrargyri Dilutum) now contains about 33.5 per cent. of metallic mercury, while mercurial ointment contains about 50 per cent.—which was formerly the strength of blue ointment.

The most noteworthy additions to the Pharmacopœia are Acetphenetidum (phenacetin), Æthylis Carbamas (urethane), Æthylis Chloridum (ethyl-chlorid), Antipyrina (antipyrin), Bromoformum (bromoform), Cresol, Gelatinum (gelatin), Glandulæ Suprarenales Siccæ (desiccated suprarenal glands), Glandulæ Thyroideæ Siccæ (desiccated thyroid glands), Guaiacol, Guaiacolis Carbonas (guaiacol carbonate), Hexamethylenamina (hexamethylenamin or urotropin), Iodolum (iodol), Liquor Formaldehydi (solution of formaldehyde), Methylthioninæ

Hydrochloridum (methylene blue), Pelletierinæ Ta letierin tannate), Scopolaminæ Hydrobromidum (s hydrobromid), Serum Antidiphthericum (diphtheria Strontii Salicylas (strontium salicylate), Sulphonethyl (trional), Sulphonmethanum (sulphonal), and Thym dum (thymol iodide or aristol).

A number of compound preparations have been i as substitutes for commercial articles of a similar, bu nite, composition. The chief of these are Cataplasn (cataplasm of kaolin, or white clay), Fluidextractun Purshianæ Aromaticum (aromatic fluidextract c sagrada), Liquor Antisepticus (antiseptic solution Cresolis Compositus (compound solution of cres Acetanilidi Compositus (compound acetanilid pov Vinum Cocæ (wine of coca).

The titles of a number of official articles have bee Thus, all Extracta Fluida have been changed to Flui Instead of writing, for example, Extracti Ergotæ I now writes Fluidextracti Ergotæ. Hydrochloridum substituted for Hydrochloras, Hydrobromidum fc bromas, Valeras for Valerianas, Arseni Trioxidum fc Arsenosum, Phenol for Acidum Carbolicum, Chlor dratum for Chloral, Betanaphthol for Naphtol, Po droxidum for Potassa, Resorcinol for Resorcinun Glycerylis Nitratis for Spiritus Glonoini, and Ver Veratrum Viride.

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# MODERN

# MATERIA MEDICA

AND

# THERAPEUTICS

# MODERN
# MATERIA MEDICA AND THERAPEUTICS.

## GENERAL CONSIDERATIONS.

**Materia medica** is that branch of medical science which treats of the remedies used in medicine. It deals with their sources, physical characters, composition, preparations, and doses.

**Pharmacy** is the art of preparing, compounding, and dispensing medicines.

**Pharmacodynamics** is the study of the action of drugs upon living organisms. Our knowledge of the action of drugs upon human beings is obtained in two ways: First, by clinical experience, and secondly, by comparative study of their action on the lower animals.

**Therapeutics** is that branch of medicine which deals with the application of remedies to disease. In its broadest sense, it has to do not only with drugs, but with all other agents which are of service in restoring health, prolonging life, or affording comfort to the sick.

Treatment based solely on clinical experience, and instituted without reference to the physiologic action of the remedies employed, constitutes *empirical therapeutics*. Thus, the giving of opium in diabetes and of salicylic acid in rheumatism, simply because experience has taught that these drugs often do good, are illustrations of empirical therapeutics.

The treatment of disease by drugs which are expected, from a knowledge of their physiologic actions, to antagonize certain known pathologic conditions, constitutes *rational therapeutics*. The employment of chloral in the convulsions of tetanus may be cited as an illustration of rational therapeutics, since it is expected that chloral, through its sedative effect, will counteract the spinal irritation which is manifesting itself in convulsions.

## COMPOSITION OF DRUGS.

The composition of the inorganic drugs is indicated by their names and formulas. The composition of the organic drugs is often exceedingly complex. They may contain fixed oils,

volatile or essential oils, resins, oleoresins, balsa
gum-resins, alkaloids, glucosids, saponins, neutral
and organic acids.

**Stereoptenes** are the solid oxidized products wh
volatile oils yield when they are cooled sufficiently
lowed to stand. Camphor, thymol, and menthol are

**Fixed oils** are oils obtained by simple pressu
not readily volatilized. Croton oil, cod-liver oil, cas
olive oil are examples of fixed oils.

**Volatile** or **essential oils** are obtained chie
tillation. They give the peculiar odor and taste
Oils of cinnamon, turpentine, mint, eucalyptus, juni
copaiba, and lemon are volatile oils.

**Resins** are exudations allied to and probably de
volatile oils. They are oxidized hydrocarbons, a
brittle, insoluble in water, but freely soluble in alcoh
unite with alkalies to form soaps. They melt at a
and solidify again on cooling. The chief official
those of copaiba, jalap, podophyllum, scammony,
acum-wood.

**Oleoresins** are stable mixtures of a volatile
resin. Their two constituents can be separated by
The oleoresins used in medicine are those of aspidi
cum, cubeb, lupulin, ginger, and black pepper.

**Balsams** are resins or oleoresins containing be
or cinnamic acid. The chief balsams are those of
and storax.

**Gums** are desiccated exudations obtained by in
limbs and branches of certain plants. They form a
or jelly with water, and are insoluble in alcohol.
important gums are those of acacia and tragacanth.

**Gum-resins** are mixtures of gum with resin
resins. Asafetida, ammoniac, myrrh, gamboge, and
are examples of gum-resins.

**Alkaloids** are nitrogenous compounds occurring
resembling ammonia in being basic and capable
salts with acids. In many instances, as in the case
morphin, aconitin, and quinin, the alkaloid repre
great extent the active properties of the drug.

**Glucosids** are compounds which, treated wit
acids or certain ferments, are resolved into two or
stances, one of which is glucose. They may be eith
or acid in reaction, and nearly all are soluble in alc
chief glucosids are arbutin, amygdalin, glycyrrhizin
marin, adonidin, digitalin, digitoxin, and strophanthi

**Saponins** are non-nitrogenous bodies, generally glucosids, which possess the property of foaming with water, emulsifying fats, and laking the red blood-cells. They are found in a number of plants, especially soap-bark, sarsaparilla, and senega. They are not absorbed from the intact alimentary canal, but have an intensely irritant local action.

**Neutral principles** are neutral or feebly acid constituents of plants, differing from glucosids in not being resolvable into glucose, and from alkaloids in not being precipitated by tannic acid or mercuric potassium iodid. Aloin, elaterin, santonin, picrotoxin, salicin, and chrysarobin belong to this class of compounds.

**Organic Acids.**—Many vegetable drugs contain organic acids, either free or combined with alkaloids or inorganic bases. The organic vegetable acids of most value in medicine are gallic, tannic, salicylic, benzoic, citric, acetic, and tartaric acids.

## PREPARATIONS OF DRUGS.

**Vinegars** (aceta) are liquid preparations made by treating vegetable drugs with diluted acetic acid. Only two are official:

Acetum Opii (vinegar of opium).

Acetum Scillæ (vinegar of squill).

**Waters** (aquæ) are aqueous solutions of volatile substances. The waters most commonly used are:

Aqua Ammoniæ (water of ammonia).

Aqua Ammoniæ Fortior (stronger water of ammonia).

Aqua Anisi (anise-water).

Aqua Aurantii Florum (orange-flower water).

Aqua Camphoræ (camphor-water).

Aqua Chloroformi (chloroform-water).

Aqua Cinnamomi (cinnamon-water).

Aqua Fœniculi (fennel-water).

Aqua Hamamelidis (hamamelis-water).

Aqua Hydrogenii Dioxidi (solution of hydrogen dioxid).

Aqua Menthæ Piperitæ (peppermint-water).

Aqua Rosæ (rose-water).

**Solutions** (liquores) are solutions of non-volatile substances in water. The official solutions contain only inorganic salts. Among the most important of this class of preparations are:

Liquor Acidi Arsenosi (solution of arsenous acid).

Liquor Ammonii Acetatis (solution of ammonium acetate, spirit of Mindererus).

Liquor Arseni et Hydrargyri Iodidi (solution of arsenous and mercuric iodids, Donovan's solution).

Liquor Calcis (solution of calcium hydroxid, lim
Liquor Chlori Compositus (compound solution
Liquor Ferri et Ammonii Acetatis (solution
ammonium acetate, Basham's mixture).
Liquor Ferri Subsulphatis (solution of ferric
Monsel's solution).
Liquor Formaldehydi (solution of formaldehyd
Liquor Iodi Compositus (compound solutio
Lugol's solution).
Liquor Magnesii Citratis (solution of magnesiu
Liquor Plumbi Subacetatis Dilutus (diluted sol
subacetate, lead-water).
Liquor Potassii Arsenitis (solution of potassi
Fowler's solution).
Liquor Potassii Citratis (solution of potassium
tral mixture).
Liquor Potassii Hydroxidi (solution of potassiu
Liquor Sodii Hydroxidi (solution of sodium hy

**Decoctions** (decocta) are liquid preparations m
ing vegetable drugs for fifteen minutes in a clos
vessel, allowing to cool, and then straining. The
freshly prepared, since they readily decompose.
official decoctions.

**Infusions** (infusa) are liquid preparations mad
to vegetable substances hot or cold water, allowi
ture to stand for a certain period, and then strain
large dose and the tendency to decompose are di
The official infusions are:

Infusum Digitalis (infusion of digitalis).
Infusum Pruni Virginianæ (infusion of wild che
Infusum Sennæ Compositum (compound infusi
black draught).

**Mixtures** (misturæ) are liquid preparations ho
pension medicinal substances. In some mixtures
syrup is used to prevent rapid precipitation of t
substance. Mixtures should be well shaken befo
ministered. The official mixtures are:

Mistura Cretæ (chalk mixture).
Mistura Ferri Composita (compound iron mixt
mixture).
Mistura Glycyrrhizæ Composita (compound
glycyrrhiza, brown mixture).
Mistura Rhei et Sodæ (mixture of rhubarb an

**Mucilages** (mucilagines) are aqueous solution
other mucilaginous substances. They are used a

as excipients for pills, and for suspending insoluble substances in liquids. The official mucilages are:

Mucilago Acaciæ (mucilage of acacia).
Mucilago Sassafras Medullæ (mucilage of sassafras pith).
Mucilago Tragacanthæ (mucilage of tragacanth).
Mucilago Ulmi (mucilage of elm).

**Syrups** (syrupi) are concentrated aqueous solutions of sugar containing medicinal or flavoring agents. The official syrups in most common use are:

Syrupus Acaciæ (syrup of acacia).
Syrupus Acidi Citrici (syrup of citric acid).
Syrupus Acidi Hydriodici (syrup of hydriodic acid).
Syrupus Aurantii (syrup of orange).
Syrupus Calcii Lactophosphatis (syrup of calcium lactophosphate).
Syrupus Ferri Iodidi (syrup of ferrous iodid).
Syrupus Ferri, Quininæ, et Strychninæ Phosphatum (syrup of the phosphates of iron, quinin, and strychnin).
Syrupus Hypophosphitum (syrup of hypophosphites).
Syrupus Hypophosphitum Compositus (compound syrup of hypophosphites).
Syrupus Ipecacuanhæ (syrup of ipecac).
Syrupus Lactucarii (syrup of lactucarium).
Syrupus Pruni Virginianæ (syrup of wild cherry).
Syrupus Rhei (syrup of rhubarb).
Syrupus Rhei Aromaticus (aromatic syrup of rhubarb).
Syrupus Sarsaparillæ Compositus (compound syrup of sarsaparilla).
Syrupus Scillæ (syrup of squill).
Syrupus Scillæ Compositus (compound syrup of squill, Coxe's hive syrup).
Syrupus Senegæ (syrup of senega).
Syrupus Tolutanus (syrup of tolu).
Syrupus Zingiberis (syrup of ginger).

Simple syrup (Syrupus) consists of water and 85 per cent. (by volume) of sugar.

**Elixirs** (elixiria) are sweetened aromatic alcoholic preparations. The official elixirs are:

Elixir Adjuvans (adjuvant elixir).
Elixir Aromaticum (aromatic elixir).
Elixir Ferri, Quininæ et Strychninæ Phosphatum (elixir of iron, quinin, and strychnin phosphates).

**Spirits** (spiritus) are alcoholic solutions of volatile substances. The most important spirits are:

Spiritus Ætheris Compositus (compound spi
Hoffmann's anodyne).
Spiritus Ætheris Nitrosi (spirit of nitrous ether)
Spiritus Ammoniæ (spirit of ammonia).
Spiritus Ammoniæ Aromaticus (aromatic spirit
Spiritus Camphoræ (spirit of camphor).
Spiritus Chloroformi (spirit of chloroform).
Spiritus Cinnamomi (spirit of cinnamon).
Spiritus Frumenti (whisky).
Spiritus Glycerylis Nitratis (spirit of glyceryl tri
of glonoin, spirit of nitroglycerin).
Spiritus Juniperi Compositus (compound spirit
Spiritus Lavandulæ (spirit of lavender).
Spiritus Menthæ Piperitæ (spirit of peppermint)
Spiritus Vini Gallici (brandy).

**Tinctures** are alcoholic or hydro-alcoholic
non-volatile (except iodin) substances. They a
simple solution, maceration, percolation, or mac
percolation. They are not so strong as the fluid e
unlike the latter, they are not all of the same defi
Most of the tinctures are made with water and
some are made with undiluted alcohol. The f
among the most important tinctures that are
alcohol and water:

Tinctura Aconiti (tincture of aconite).
Tinctura Aurantii Amari (tincture of bitter oran
Tinctura Belladonnæ Foliorum (tincture of
leaves).
Tinctura Calumbæ (tincture of calumba).
Tinctura Capsici (tincture of capsicum).
Tinctura Cardamomi Composita (compound
cardamom).
Tinctura Cinchonæ (tincture of cinchona).
Tinctura Cinchonæ Composita (compound tin
chona, Huxham's tincture).
Tinctura Colchici Seminis (tincture of colchicu
Tinctura Digitalis (tincture of digitalis).
Tinctura Gambir Composita (compound tincture
Tinctura Gelsemii (Tincture of gelsemium).
Tinctura Gentianæ Composita (compound
gentian).
Tinctura Guaiaci Ammoniata (ammoniated
guaiac).
Tinctura Hyoscyami (tincture of hyoscyamus).
Tinctura Kino (tincture of kino).

Tinctura Krameriæ (tincture of krameria).
Tinctura Lavandulæ Composita (compound tincture of lavender).
Tinctura Lobeliæ (tincture of lobelia).
Tinctura Nucis Vomicæ (tincture of nux vomica).
Tinctura Opii (tincture of opium, laudanum).
Tinctura Opii Camphorata (camphorated tincture of opium, paregoric).
Tinctura Opii Deodorati (tincture of deodorized opium).
Tinctura Quassiæ (tincture of quassia).
Tinctura Rhei (tincture of rhubarb).
Tinctura Stramonii Seminis (tincture of stramonium seed).
Tinctura Strophanthi (tincture of strophanthus).
Tinctura Valerianæ Ammoniata (ammoniated tincture of valerian).

The following official tinctures are made with undiluted alcohol:

Tinctura Asafœtidæ (tincture of asafetida).
Tinctura Aurantii Dulcis (tincture of sweet orange-peel).
Tinctura Benzoini (tincture of benzoin).
Tinctura Benzoini Composita (compound tincture of benzoin).
Tinctura Cannabis Indicæ (tincture of Indian cannabis).
Tinctura Cantharidis (tincture of cantharides).
Tinctura Cimicifugæ (tincture of cimicifuga).
Tinctura Guaiaci (tincture of guaiac).
Tinctura Iodi (tincture of iodin).
Tinctura Physostigmatis (tincture of physostigma).
Tinctura Veratri (tincture of veratrum, tincture of veratrum viride).

**Fluid Extracts** (fluidextracta) are liquid preparations (alcoholic or hydro-alcoholic) of organic drugs, so made that one cubic centimeter represents the active properties of one gram of the crude drug. The most important fluid extracts are:

Fluidextractum Belladonnæ Radicis (fluid extract of belladonna root).
Fluidextractum Buchu (fluid extract of buchu).
Fluidextractum Cannabis Indicæ (fluid extract of cannabis indica).
Fluidextractum Cimicifugæ (fluid extract of cimicifuga).
Fluidextractum Cinchonæ (fluid extract of cinchona).
Fluidextractum Cocæ (fluid extract of coca).
Fluidextractum Conii (fluid extract of conium).
Fluidextractum Ergotæ (fluid extract of ergot).

Fluidextractum Gelsemii (fluid extract of gelser
Fluidextractum Glycyrrhizæ (fluid extract of gly
Fluidextractum Hydrastis (fluid extract of hydr
Fluidextractum Hyoscyami (fluid extract of hyo
Fluidextractum Nucis Vomicæ (fluid extra
vomica).
Fluidextractum Pilocarpi (fluid extract of piloca
Fluidextractum Rhamni Purshianæ (fluid extrac
sagrada).
Fluidextractum Rhois Glabra (fluid extract of rl
Fluidextractum Sarsaparillæ (fluid extract of sa
Fluidextractum Sarsaparillæ Compositum (com
extract of sarsaparilla).
Fluidextractum Sennæ (fluid extract of senna).
Fluidextractum Spigeliæ (fluid extract of spigeli
Fluidextractum Uvæ Ursi (fluid extract of uva u
Fluidextractum Veratri (fluid extract of veratrur
tract of veratrum viride).
Fluidextractum Viburni Opuli (fluid extract o
opulus).
Fluidextractum Viburni Prunifolii (fluid extract
prunifolium).

**Wines** (vina) are alcoholic liquids made by ferm
juice of fresh grapes. *Medicated wines* are alcohol
tions in which white wine is used as a menstruum.
cial wines are:

Vinum Album (white wine).
Vinum Antimonii (wine of antimony).
Vinum Cocæ (wine of coca).
Vinum Colchici Seminis (wine of colchicum seed
Vinum Ergotæ (wine of ergot).
Vinum Ferri (wine of iron, wine of ferric citrate).
Vinum Ferri Amarum (bitter wine of iron).
Vinum Ipecacuanhæ (wine of ipecac).
Vinum Opii (wine of opium).
Vinum Rubrum (red wine).

**Emulsions** (emulsa) are aqueous preparations
by the aid of some mucilaginous material, insolub
resinous substances are suspended in the form
particles or globules. The chief excipients used
emulsions are acacia, tragacanth, and yelk of egg.
preparations in large quantity are incompatible with
since they precipitate the excipient, the gum, or
official emulsions are:

Emulsum Amygdalæ (emulsion of almond).
Emulsum Asafœtidæ (emulsion of asafetida).
Emulsum Chloroformi (emulsion of chloroform).
Emulsum Olei Morrhuæ (emulsion of cod-liver oil).
Emulsum Olei Morrhuæ cum Hypophosphitibus (emulsion of cod-liver oil with hypophosphites).
Emulsum Olei Terebinthinæ (emulsion of oil of turpentine).

**Honeys** (mellita) are liquid preparations in which honey is used as a menstruum. The official honeys are:
Mel (honey).
Mel Despumatum (clarified honey).
Mel Rosæ (honey of rose).

**Liniments** (linimenta) are liquid preparations containing oleaginous substances, and intended for external application. With the exception of belladonna liniment and lime liniment, which are used as sedative applications, all the official liniments are of a stimulating character, and are to be applied with friction. The official liniments are:
Linimentum Ammoniæ (ammonia liniment).
Linimentum Belladonnæ (belladonna liniment).
Linimentum Calcis (lime liniment, carron oil).
Linimentum Camphoræ (camphor liniment).
Linimentum Chloroformi (chloroform liniment).
Linimentum Saponis (soap liniment).
Linimentum Saponis Mollis (liniment of soft soap, tincture of green soap).
Linimentum Terebinthinæ (turpentine liniment).

**Lotions** (lotiones) are weak medicated solutions or mixtures for external use. When intended for the eyes, they are known as *collyria*. Collyria are usually applied by means of a pipet with a rubber bulb. There are no official lotions, but the following are in common use:
Lotio Plumbi et Opii (lead-water and laudanum: lead acetate, 120 gr. (8.0 gm.); tincture of opium, ½ fl. oz. (15 c.c.); water, 16 fl. oz. (475 c.c.)).
Lotio Hydrargyri Flava (yellow wash: corrosive sublimate, 24 gr. (1.5 gm.); lime-water, 16 fl. oz. (475 c.c.)).
Lotio Hydrargyri Nigra (black wash: calomel, 64 gr. (4.0 gm.); lime-water, 16 fl. oz. (475 c.c.)).

**Collodions** (collodia) are liquid preparations having for a menstruum a solution of pyroxylin (gun-cotton) in ether and alcohol. They are used externally, and are applied by means of a brush. With the exception of cantharidal collodion, which is used for blistering the skin, they are chiefly employed as protectants. The official collodia are:

Collodium (collodion).

Collodium Cantharidatum (cantharidal collodic collodion).

Collodium Flexile (flexile collodion).

Collodium Stypticum (styptic collodion).

**Glycerites** (glycerita) are solutions of drugs The following are official:

Glyceritum Acidi Tannici (glycerite of tannic a

Glyceritum Amyli (glycerite of starch).

Glyceritum Boroglycerini (glycerite of borogly

Glyceritum Ferri, Quininæ et Strychninæ Phospl erite of the phosphates of iron, quinin, and strych

Glyceritum Hydrastis (glycerite of hydrastis).

Glyceritum Phenolis (glycerite of phenol, glyc bolic acid).

**Enemas or Clysters** (enemata) are liquid intended for injection into the rectum. There a enemas.

**Extracts** (extracta) are solid or semisolid made by evaporating solutions of vegetable d menstrua are alcohol, diluted alcohol, water, ammonia-water, diluted acetic acid, or acetic acid alcohol. Being concentrated and solid or semiso well adapted for administering in the form of pills. important extracts are:

Extractum Aloes (extract of aloes).

Extractum Belladonnæ Foliorum (extract of leaves).

Extractum Cannabis Indicæ (extract of cannabi

Extractum Cimicifugæ (extract of cimicifuga).

Extractum Colchici Cormi (extract of colchicum

Extractum Colocynthidis (extract of colocynth)

Extractum Colocynthidis Compositum (compo of colocynth).

Extractum Digitalis (extract of digitalis).

Extractum Ergotæ (extract of ergot).

Extractum Euonymi (extract of euonymus).

Extractum Gentianæ (extract of gentian).

Extractum Glycyrrhizæ (extract of glycyrrhiza)

Extractum Glycyrrhizæ Purum (pure extract rhiza).

Extractum Hæmatoxyli (extract of hematoxylo

Extractum Hyoscyami (extract of hyoscyamus)

Extractum Jalapæ (extract of jalap).

Extractum Malti (extract of malt).

Extractum Nucis Vomicæ (extract of nux vomica).
Extractum Opii (extract of opium).
Extractum Physostigmatis (extract of physostigma).
Extractum Quassiæ (extract of quassia).
Extractum Rhamni Purshianæ (extract of cascara sagrada).
Extractum Rhei (extract of rhubarb).
Extractum Stramonii (extract of stramonium).
Extractum Sumbul (extract of sumbul).
Extractum Uvæ Ursi (extract of uva ursi).

**Masses** (massæ) are soft-solid preparations preserved in bulk and intended for forming into pills. The official masses are:

Massa Ferri Carbonatis (mass of ferrous carbonate, Vallet's mass).
Massa Hydrargyri (mass of mercury, blue mass, blue pill).

**Pills** (pilulæ) are small rounded masses containing one or more medicinal substances held together by some adhesive material, known as an excipient. The usual excipients are water, glycerin, tragacanth, acacia, honey, bread-crumbs, soap, confection of rose, extract of glycyrrhiza, and extract of gentian. Ordinarily, pills should not exceed in weight 5 grains, unless made of very heavy drugs of small bulk. The official pills are:

Pilulæ Aloes (pills of aloes).
Pilulæ Aloes et Ferri (pills of aloes and iron).
Pilulæ Aloes et Mastiches (pills of aloes and mastich).
Pilulæ Aloes et Myrrhæ (pills of aloes and myrrh).
Pilulæ Asafœtidæ (pills of asafetida).
Pilulæ Catharticæ Compositæ (compound cathartic pills).
Pilulæ Carthartícæ Vegetabiles (vegetable cathartic pills).
Pilulæ Ferri Carbonatis (pills of carbonate of iron; Blaud's pills).
Pilulæ Ferri Iodidi (pills of ferrous iodid).
Pilulæ Laxativæ Compositæ (compound laxative pills).
Pilulæ Opii (pills of opium).
Pilulæ Phosphori (pills of phosphorus).
Pilulæ Podophylli Belladonnæ et Capsici (pills of podophyllum, belladonna, and capsicum).
Pilulæ Rhei Compositæ (compound pills of rhubarb).

**Confections** (confectiones) are soft masses made by mixing drugs with sugar and water or honey. Only two are official:

Confectio Rosæ (confection of rose).
Confectio Sennæ (confection of senna).

**Powders** (pulveres) are drugs in the form of fine, loose, uncompacted particles. They are commonly dispensed in

small paper packages, known as *chartulæ*. But th not suitable for highly volatile, hygroscopic, efflc deliquescent substances, or drugs with a disagre When not suitable for papers, powders may be d capsules or cachets. *Capsules* are small gelatin cas opes (hard or soft) in which liquid or solid me enclosed to be swallowed. *Cachets* are round con made of flour and water. The drug is contained ir formed by bringing together the concave surfa wafers. Their edges are fastened by being moi then pressed together. They are well adapted fo powders having a disagreeable taste. They shoul floated on a small quantity of water.

**Triturates** (triturationes) are fine powders o substances intimately mixed with sugar of milk. only one official triturate:

Trituratio Elaterini (triturate of elaterin).

**Tablets** (tabellæ) are small disks containing me stances mixed with sugar, and pressed into shape moulds. They are a convenient form in which to concentrated remedies, such as calomel, morphin, nin. There are no official tablets.

**Troches** or **lozenges** (trochisci) are small, cy flat, solid masses, containing medicinal agents mixed and mucilage. Most of them are intended to ir mucous membrane of the throat. The official troc

Trochisci Acidi Tannici (troches of tannic acid).

Trochisci Ammonii Chloridi (troches of ammoniu

Trochisci Cubebæ (troches of cubeb).

Trochisci Gambir (troches of gambir).

Trochisci Glycyrrhizæ et Opii (troches of glyc opium).

Trochisci Krameriæ (troches of krameria).

Trochisci Potassii Chloratis (troches of potassiu

Trochisci Santonini (troches of santonin).

Trochisci Sodii Bicarbonatis (troches of sodium b

**Suppositories** (suppositoria) are solid bodies, shapes, intended to be inserted into the rectum, vag or nostril. The usual base is oil of theobroma. poured while in liquid form into suitable moulds lidified by cooling on ice. The only official suppos

Suppositoria Glycerini (suppositories of glycerin

**Ointments** (unguenta) are soft fatty preparatio at the temperature of the body, and containing me stances incorporated with a base of lard, a fixed oil, wax, or spermaceti. The official ointments are:

Unguentum Acidi Borici (ointment of boric acid).
Unguentum Acidi Tannici (ointment of tannic acid).
Unguentum Aquæ Rosæ (ointment of rose-water, cold cream).
Unguentum Belladonnæ (belladonna ointment).
Unguentum Chrysarobini (chrysarobin ointment).
Unguentum Diachylon (diachylon ointment).
Unguentum Gallæ (nutgall ointment).
Unguentum Hydrargyri (mercurial ointment).
Unguentum Hydrargyri Ammoniati (ointment of ammoniated mercury).
Unguentum Hydrargyri Dilutum (blue ointment).
Unguentum Hydrargyri Nitratis (ointment of mercuric nitrate, citrine ointment).
Unguentum Hydrargyri Oxidi Flavi (ointment of yellow mercuric oxid).
Unguentum Hydrargyri Oxidi Rubri (ointment of red mercuric oxid).
Unguentum Iodi (iodin ointment).
Unguentum Iodoformi (iodoform ointment).
Unguentum Phenolis (ointment of phenol, ointment of carbolic acid).
Unguentum Picis Liquidæ (tar ointment).
Unguentum Potassii Iodidi (ointment of potassium iodid).
Unguentum Stramonii (stramonium ointment).
Unguentum Sulphuris (sulphur ointment).
Unguentum Veratrinæ (veratrin ointment).
Unguentum Zinci Oxidi (ointment of zinc oxid).
Unguentum Zinci Stearatis (ointment of zinc stearate).

**Oleates** (oleata) are solutions of metallic oxids or alkaloids in oleic acid. There are five official oleates:

Oleatum Atropinæ (oleate of atropin).
Oleatum Cocainæ (oleate of cocain).
Oleatum Hydrargyri (oleate of mercury).
Oleatum Quininæ (oleate of quinin).
Oleatum Veratrinæ (oleate of veratrin).

**Cerates** (cerata) are solid fatty preparations resembling ointments, but made firmer by the addition of wax. They are of such consistence that they soften but do not melt at the body-temperature. The official cerates are:

Ceratum (cerate).
Ceratum Camphoræ (camphor cerate).
Ceratum Cantharidis (cantharides cerate).
Ceratum Plumbi Subacetatis (cerate of lead subacetate, Goulard's cerate).

Ceratum Resinæ (rosin cerate, basilicon ointment)
Ceratum Resinæ Compositum (compound rosin c

**Plasters** (emplastra) are solids having a fatty c base, and of such consistence that they do not become adhesive when applied to the surface of The official plasters are:

Emplastrum Adhæsivum (adhesive plaster).
Emplastrum Belladonnæ (belladonna plaster).
Emplastrum Capsici (capsicum plaster).
Emplastrum Hydrargyri (mercurial plaster).
Emplastrum Opii (opium plaster).
Emplastrum Plumbi (lead plaster, diachylon plast
Emplastrum Saponis (soap plaster).

**Papers** (chartæ) are strips of paper impregnated with some medicinal substances. They are inten moistened and applied as a plaster, or else to be b the fumes inhaled. One paper is official:

Charta Sinapis (mustard paper).

**Poultices** (cataplasmata) are soft semiliquid pr made of some cohesive substance, mixed with wa used for applying heat and moisture to the tissu securing a local stimulant effect. They are usuall flaxseed meal, slippery elm, or bread and milk. may be added as an absorbent, mustard as a stim laudanum as an anodyne. Only one cataplasm is o

Cataplasma kaolini (cataplasm of kaolin).

## INCOMPATIBILITY IN PRESCRIPTIO

Incompatibility in a prescription has been defin condition in which there exists either "a chemical d tion, a pharmaceutic dissociation, or a therapeutic o of its constituents. The term is thus susceptible meanings. A prescription is chemically incompati chemical change results; it is pharmaceutically inc where there is violation of correct pharmaceutic p and there is therapeutic incompatibility where there nism in physiologic action. Now, accepting these c a prescription may be chemically incompatible, and what the physician wants. It may be pharmaceutica patible, and yet be desirable for the same reason. never desirable when a change of chemical comp

[1] This article has been written by Joseph W. England, PH.

pharmaceutic character results in the formation of new products having totally different therapeutic effects than those obviously intended. And this view—the intended therapeutic action of the prescription—the pharmacist should ever bear in mind.

Every new prescription is largely a law unto itself until tried. Expertness in pharmaceutic manipulation, of which prescription-work is the highest type, is a matter of individual ability, which can be acquired only in the largest and best measures by personal experience. The subject of incompatibility is not a formidable one if there primarily exists a clear knowledge of the chemical or pharmaceutic properties of the substances used, so that any deviation from the right standard may be detected; but here is the puzzling question, How are we to know but that, in the event of some chemical or pharmaceutic change, the physician does not mean just such a change, and nothing else?

At first glance it seems strange, but there are some most successful physicians who, every now and then, write pharmaceutically and chemically, the most incompatible prescriptions. Yet they have success; and their happy results can only be due to the certain formation of new products or an alteration in pharmaceutic character of old ones. It does not follow that all prescriptions thus written are of the highest therapeutic value. Far from it. The tendency of the times is steadily in the direction of greater simplicity in prescription-writing.

It is to be regretted that the physician often depends in large measure upon the pharmacist for detecting any chemical or pharmaceutic incompatibility, and that the pharmacist depends solely and alone upon the physician for recognizing any therapeutic incompatibility. A physician, with his many duties, cannot be expected to have at his command the vast detail of pharmaceutic facts, nor can the pharmacist be considered negligent in not possessing an extended acquaintance with the application of drugs in medicine; but it is clear that some elementary knowledge as to how drugs act and for what purposes they may be employed would be of great practical value to the pharmacist in affording him a clear idea of the therapeutic intent of the prescriber, and the ability to detect any deviation through a chemical or pharmaceutic error. An argument for therapeutic knowledge is not a step in the direction of counter-prescribing. It is only a plea for broader education—for elementary therapeutics on distinctly pharmaceutic lines. With therapeutics pure and simple the pharmacist has nothing whatever to do. That is solely the province of the

physician. Medicine and pharmacy are making
tific progress—not in the same way, but upon ce
lines of work and study, yearly becoming more
widely separated, rendering each the more depen
other.

To render a knowledge of the solubilities and
of inorganic compounds readily accessible, the fol
is presented, based almost wholly upon Profess
"Statement of the Solubilities and Insolubilitie
which expresses, directly or by inference, nearly
soluble and insoluble compounds of the followi
basylous radicals: aluminum, ammonium, antim
bismuth, cadmium, calcium, chromium, cobalt, c
ferrous, gold, lead, lithium, magnesium, mangane
mercurous, nickel, potassium, silver, sodium, stan
strontium, and zinc.

In using this table it is only needful to rememl
known chemical law that when a solution of a
brought in contact with a solution of another con
by an interchange of radicals, an insoluble comp
dered possible, that compound will be precipitate

Acetates are soluble.

Arsenates are insoluble, except those of the all

Arsenites are insoluble, except those of the alk

Bromids are soluble, except mercurous and silv
antimony and bismuth are decomposed by wa
oxysalts.

Carbonates are insoluble, except those of the a

Chlorids are soluble, except those of lead (*s*)
and silver.

Citrates are soluble, except those of manganese
silver, and strontium, aluminum (*s*), barium (*s*),
cadmium (*s*), calcium (*s*), lead (*s*), zinc (*s*).

Cyanids are insoluble, except the mercuric and
alkaline metals and earths.

Hydrates are insoluble, except those of bariu
calcium (*s*), lead (*s*), and the alkali metals.

Iodids are soluble, except those of antimony, bi
lead (*s*), mercuric, mercurous, platinum (*s*), and si

Nitrates are soluble.

Oxalates are insoluble, except those of antimo
mium, ferric (*s*), ferrous (*s*), stannic, and the alkali

Oxids are insoluble, except those of barium, st
cium (*s*), and the alkaline metals.

[1] (*s*) means sparingly soluble.

Phosphates (ortho) are insoluble, except those of the alkali metals.

Sulphates are soluble, except those of barium, strontium, calcium (*s*), antimony, lead, mercurous (*s*), and silver (*s*).

Sulphids are insoluble, except those of barium, calcium (*s*), strontium, and the alkali metals.

Sulphites are soluble, except those of aluminum, antimony, barium, bismuth, calcium (*s*), cobalt (*s*), copper, ferrous (*s*), lead, manganese (*s*), nickel (*s*), silver, stannous, strontium, and zinc (*s*).

Tartrates are soluble, except those of antimony, barium, bismuth, cadmium (*s*), calcium (*s*), copper (*s*), ferrous (*s*), lead, manganese (*s*), mercuric, mercurous, nickel (*s*), silver, strontium (*s*), and zinc (*s*).

Acids decompose hydrates, carbonates, and acid carbonates to form salts; the stronger acids, which are largely inorganic, set free the weaker acids, which are largely organic; or, brought in contact with alcohol or alcoholic solutions, form ethers; alkaline hydrates, carbonates, and acid carbonates neutralize free acids, decompose some glucosids, and precipitate all alkaloids, some of which precipitates are soluble in excess of the precipitant, or in alcohol, if that liquid be present in sufficient amount to dissolve them.

Oxidizing agents, such as nitric, hydrochloric, nitrohydrochloric, picric, and chromic acids, and potassium bichromate and permanganate, with readily oxidizable substances, such as carbohydrates, alcohols, ethers, sulphur, phosphorus, sulphids, and organic matter in general, form explosive compounds. Potassium permanganate, if ordered in pill form, can best be made with cacao butter and cosmolin in very small quantity, and enclosed in gelatin capsules. Silver nitrate is reduced by organic matter to oxid, with the exception, it is said, of opium and extract of hyoscyamus. A very good way of making pills of it is with cacao butter and cosmolin, etc., as mentioned above under potassium permanganate; syrup of ferrous iodid and potassium chlorate form a poisonous compound, and potassium iodid and potassium chlorate form a mixture which yields the poisonous iodate on being taken internally.[1]

Iodin and iodids yield precipitates with the alkaloids; bromids precipitate morphin and strychnin salts on standing, but a few drops of dilute hydrochloric acid added, after the addition of the alkaloid, prevents the change. Sodium biborate precipitates morphin and cocain salts, but on the addition of a small quantity of boric acid, or with boric acid alone, precipi-

[1] *Am. jour. Phar.*, p. 277, 1876.

tation does not take place. Mercuric chlorid wit solutions of the alkaloids forms crystalline double sium-mercuric iodid precipitates alkaloidal solut tions of quinin salts with those of the alkaline with Basham's mixture, precipitate the sparingly nin acetate. Morphin solutions give the pheno mixed with tincture of ferric chlorid.

Glucosids are decomposed by free acids and pr tannin; tannic and gallic acids precipitate alkalo gelatin, and the majority of metallic salts, and yi iron solutions.

Resinous tinctures and fluid extracts prescribe ous solutions should always be emulsified with ures and fluid extracts made of stronger alcoho those made of diluted alcohol, become turbid an since the special solvent power of alcohol or o substance diminishes in proportion to the quantity liquid present. A "shake" label should always

When for internal use, fixed and volatile oils a and aqueous solutions should always be emulsi ordered or not, and to better emulsify the vola should have mixed with them, prior to emulsifica volume of olive, almond, or cotton-seed oil.

Tincture of ferric chlorid gelatinizes mucilag free acids separate insoluble carminic acids fro tincture of cardamom; free acids precipitate glyc fluid extract of licorice.

Commercial spirit of nitrous ether liberates iod tions of iodids, decomposes antipyrin solutions to nitroderivative, and precipitates mucilage of acac well diluted with water it can usually be added precipitating. Tincture of guaiac and spirit of are stated to be pharmaceutically incompatibl although they are often prescribed together; lik of wild cherry with compound infusion of gentia cinchona with compound infusion of gentian, with metallic salts generally.

Sodium salicylate in solution precipitates soluble salicylic acid if mixed with acids, and pensed in powders with potassium acetate, the cent potassium salicylate. Sodium salicylate ir tion is decomposed by tincture of ferric chlori diluted first changes only into ferric salicyla benzoate solution is decomposed by acids to y ingly soluble benzoic acid.

Mercuric chlorid is decomposed by solution of potassium arsenite, but if the alkaline solution has first added to it, in slight excess, diluted hydrochloric acid, no precipitation will take place on the addition of the mercurial salt. Pyrophosphate and phosphate of iron solutions precipitate with dilute phosphoric acid. The National Formulary recommends the usage of dilute metaphosphoric acid in place of the official "ortho" variety, as yielding a permanently clear solution.

In conclusion, the writer would say that in this brief article he has endeavored to present, not an exhaustive list of special incompatibles, but simply a general expression of those liable to occur in the every-day routine of prescription-work.

## METHODS OF ADMINISTERING DRUGS.

**By the Mouth.**—This is the most common method. Drugs may be administered by the mouth for their local action on the mouth, throat, stomach, or intestines, or for the purpose of being absorbed. When it is desired to influence the mouth or throat, the remedy is generally given in the form of a lozenge, and the patient advised not to take food or water for at least an hour afterward. Remedies intended to act directly on the mucous membrane of the stomach should be given when the stomach is empty, that is, half an hour or an hour before meals. Drugs intended to exert a direct influence on the intestine should be given two or three hours after meals, and preferably in firm pills. Sometimes such pills are coated with a substance, like keratin, that will resist the action of the gastric juice.

Absorption may take place from any part of the alimentary canal. Powerful remedies, as nitroglycerin and tincture of aconite, are readily absorbed from the tongue. Absorption from the stomach is effected most quickly, as a rule, when the drug is given in solution on an empty stomach. However, in the case of remedies that have a local irritant action, it is far better to give them immediately after meals, so that by becoming mixed with the food their local effect is more or less avoided.

A few remedies, such as calomel and salol, are digested almost entirely in the intestine.

**Hypodermic Method.**—This consists in injecting medicinal solutions into the subcutaneous tissue by means of the hypodermic needle and syringe. The advantages of this method are the great rapidity with which absorption is effected, and the certainty of securing the action of the entire

dose, since partial destruction of the remedy by t
organs is avoided. The disadvantages of this
the pain inflicted, the liability of causing absce
risk of throwing the solution directly into a
alkaloidal salts, on account of their small bulk, a
adapted for hypodermic use. Some remedies, su
and antitoxins, are effective only when administ
taneously. The best places to select for the i
the extensor surface of the arm, the calf of the leg
inal wall, and the buttock. Both the needle and
should be sterile. All the air should be expel
syringe before the injection is given, and great ca
exercised to avoid entering a vein. The dose
administered hypodermically is ordinarily about
that given by the mouth.

**Intravenous Injection.**—This method is en
in great emergency. Saline solution may be gi
ously in copious hemorrhage, uremia, diabetic c
the algid stage of cholera. In the collapse of a
ing, diffusible stimulants—ammonia-water, ethe
may be introduced into the system through the

**By the Rectum.**—Absorption through the
effected near so rapidly as through the stomach.
plish the same result it is generally necessary
the dose by the rectum that would be required b
This method is convenient when the stomach is
It also affords a means of acting directly on th
drugs, and of removing hardened feces, flatus, a
When the enema is to be retained in the bowe
effect, the fluid should be warm, the quantity
exceed two ounces, and the injection should b
slowly. When the enema is intended to bring
tion, one or two pints of fluid may be emplo
flatus is to be removed, an enema consisting
6 ounces of the emulsion of asafetida is effe
local and constitutional effects may also be secu
of suppositories containing medicinal agents.

**Inunction.**—Many medicinal substances, if
fats, are fairly well absorbed through the unbrok
cially if friction be used in their application.
method of administration is employed systematic
a constitutional effect, different surfaces shoul
each day. The best surfaces for inunction are t
thin skin, such as the axillæ, popliteal spaces, th
the inner sides of the thighs. The drugs that

quently introduced by inunction are mercury and iodin. A convenient method of treating syphilis in infants is by smearing mercurial ointment on a flannel binder worn around the abdomen.

**Endermic Method.**—This method consists in raising a blister, removing the epidermis, and sprinkling on the raw derm the drug that is to be absorbed. It is very painful, and it is far less satisfactory than the hypodermic method.

**Fumigation.**—This method is sometimes employed in syphilis instead of inunction. A mercurial salt, preferably calomel, is volatized from a tin plate suspended over a spirit-lamp. The latter is placed under a cane-seated chair, upon which is seated the patient, disrobed and surrounded by a blanket fastened to the neck.

**Inhalation.**—Volatile drugs are rapidly absorbed from the respiratory tract, and this method is especially employed for the administration of drugs which induce general anesthesia, such as ether, chloroform, and nitrous oxid. The effect of other volatile substances, like amyl nitrite, is also secured by inhalation. Medicated vapors and sprays are employed to influence directly the mucous membrane of the respiratory tract.

## CIRCUMSTANCES MODIFYING THE EFFECT OF DRUGS.

The effect of drugs is modified by many circumstances, chief of which are the age of the patient, sex, race, body-weight, temperament, disease, temperature, habit, idiosyncrasy, method of administration, time of administration, preparation of the drug, and dose.

**Habit.**—With many drugs continuous use induces toleration. This is particularly true of opium. Increased elimination and diminished absorption may play a part in the development of this condition, but it is probably due very largely to a change in the tissues themselves, whereby they are rendered less susceptible to the influence of the drug.

**Idiosyncrasy.**—This is a peculiar susceptibility or insusceptibility of one or more of the tissues to the influence of certain drugs. Less than ¼ of a grain of calomel has been known to induce salivation. The smallest dose of quinin will in some individuals cause a diffuse erythematous rash.

**Cumulative Action.**—This is the property which some drugs have, after they have been given for a certain length of time, of producing a severe and more or less sudden effect.

It is probably due in most instances to an accu
the drug in the tissues, excretion, for one reason
being less rapid than absorption. In some cases,
may depend upon irregular absorption, a large qu
drug suddenly entering the circulation from the
canal, where, owing to some accidental conditio
been an undue accumulation.

## DOSAGE.

The circumstances which modify the effect of
also necessarily influence dosage. The most imp
ditions to be considered are the age, sex, weight,

**Age.**—Children require smaller doses than a
rules are in common use for determining the pro
children of different ages:

Young's rule is as follows: Add 12 to the age
by the age, and the quotient will be the denon
fraction the numerator of which is 1. Thus, fo
four years, $\frac{4+12}{4}=4$, and the dose is $\frac{1}{4}$ that fo

Cowling's rule is to divide the age of the chil
birthday by 24. Thus, for a child 3 years ol
would be $\frac{4}{24}=\frac{1}{6}$ of the adult dose.

These rules, of course, are only approximately
each drug must be considered by itself in refere
Thus, children are very susceptible to opium, an
the dose of this drug must be smaller than the
apparently indicate. On the other hand, arseni
donna are well borne by children, and, therefor
larger doses of these drugs can be prescribed.

**Sex.**—Women generally require smaller dose
The dose for a woman is about four-fifths of tha

**Weight.**—Weight has less influence on dosage
age or sex, but a very heavy muscular individual w
require a larger dose than one of slight frame.

# DRUGS.

## CIRCULATORY STIMULANTS.

CIRCULATORY stimulants are drugs which increase the efficiency of the heart. They may increase the force of the beat and lessen its rate, or they may increase both the force and the rate of the beat. Among those which strengthen the heart-beat, but decrease its frequency, are the following:

| | |
|---|---|
| Digitalis. | Squill. |
| Strophanthus. | Canadian hemp (apocynum). |
| Convallaria. | Adrenalin. |
| Adonis vernalis. | Strychnin. |

Among those which increase both the force and frequency of the beat may be mentioned the following:

| | |
|---|---|
| Caffein. | Atropin. |

A number of drugs quicken the heart-beat and slightly increase the output of the heart per unit of time, not so much by acting on the heart directly as by causing peripheral irritation and a reflex stimulation of the organ. The effect of these drugs on the circulation is necessarily transitory. The important members of this group are:

| | |
|---|---|
| Ammonia. | Ether. |
| Alcohol. | Camphor. |

**Increase of Blood-pressure.**—A drug may increase the blood-pressure (1) by stimulating the heart directly (digitalis, strophanthus, partly in this way); (2) by constricting the vessels directly (adrenalin); (3) by constricting the vessels through a central action (digitalis, strychnin, atropin). The blood-

pressure may also be increased by compression of th vessels, as in the pneumatic rubber suit devised by by increasing the amount of fluid in the vessels (s intravenously or subcutaneously).

**Acceleration of the Heart-beat.**—This can about (1) by excitement or peripheral irritation (alc (2) by stimulation of the heart itself (caffein); (3) b pression of the inhibitory nerves, centrally or (belladonna); (4) by reduction of the blood-press direct depression of the inhibitory centers in t (nitrites, partly in this way); and (5) theoretically, tion of the accelerator mechanism of the heart.

Circulatory stimulants are indicated in heart-failu motor paresis from various causes. In collapse, qu stimulants, such as ammonia, alcohol, and camph effective, especially when their administration is co the external application of heat and the injection tion intravenously, subcutaneously, or into the shock (exhaustion of the vasomotor centers) the ures also may be used, but they are not likely to p cacious as intravenous injections of adrenalin, wh constricts the peripheral vessels, and thus serves the tonus in the medulla oblongata.

Circulatory stimulants with a constricting effe peripheral arteries, like digitalis, are often exceed in valvular disease of the heart with simple dilatatio when there is dropsy. For a certain degree of te arteries it is necessary (1) to equalize the two circ to keep the coronary arteries well filled and so se heart-muscle the requisite amount of nourishment, mote diuresis. When, however, the myocardium of advanced degenerative changes, drugs like digit used with considerable caution, since their constricti upon the vessels may be much more pronounced stimulating effect upon the heart. In such cases a as one of the nitrites, should also be given, or a hea selected that will cause less contraction of the mus of the vessels. Drugs with the digitalis action also a in cases of cardiac incompetence by diminishing t of the heart's contractions (prolonging the diast and thus giving more rest to the crippled organ.

In heart-weakness resulting from asthenic fever the digitalis group are generally less beneficial th strychnin, and caffein.

## AMMONIA.

($NH_3$.)

Ammonia is a colorless gas having an intensely pungent odor and acrid taste, and obtained as a by-product in the manufacture of coal-gas. It acts as a base in uniting with acids to form salts.

| Preparations. | Dose. |
|---|---|
| Aqua Ammoniæ, U. S. P. (10 per cent. of the gas) | 10–30 min. (0.6–2.0 c.c.). |
| Aqua Ammoniæ Fortior, U. S. P. (28 per cent. of the gas). | |
| Spiritus Ammoniæ, U. S. P. (10 per cent. of the gas) | 20–60 min. (1.0–4.0 c.c.) |
| Spiritus Ammoniæ Aromaticus, U. S. P. (ammonium carbonate, 34; ammonia-water, 90; aromatic oils; water to make 1000 parts) | 20–60 min. (1.0–4.0 c.c.). |
| Linimentum Ammoniæ, U. S. P. | |

**Physiologic Action.**—**Circulatory System.**—Both the inhalation of ammonia and the administration of its preparations by the mouth produce a transient elevation of the blood-pressure. This effect is due not to the direct action of the drug on the heart, but to the reflex stimulation of the organ and also of vasomotor center in the medulla from irritation of the nasal or gastric mucous membrane. Sometimes temporary slowing of the pulse is observed as the result of reflex stimulation of the inhibitory center. Elevation of blood-pressure also occurs when ammonia is injected subcutaneously or intravenously if the dose be moderate, but in this case the vasomotor center is, probably, stimulated directly as well as reflexly. Very large doses of ammonia, administered intravenously, lower the blood-pressure by directly depressing the vasomotor center and the heart.

**Respiratory System.**—Moderate doses increase the depth and volume of the respirations by stimulating reflexly the respiratory center in the medulla. This effect is especially pronounced when the drug is administered by inhalation.

**Alimentary Canal.**—In the stomach, ammonia, like other alkalis, serves to neutralize any free acid that may be present, and in dilute solution is sufficiently stimulating to act as a carminative.

**Local Action.**—Locally, it is a powerful irritant, though its action is not corrosive like that of the fixed alkalis. Even in concentrated solution it does not dissolve the epidermis, but passes through it and produces a blister.

**Elimination.**—As ammonia undergoes rapid d
in the body, its action is very evanescent. Unli
alkalis, it does not add to the alkalinity of the u
absorption it is transformed into urea, in whic
excreted.

**Toxicology.**— Ammonia-poisoning is char
severe burning pain in the fauces, esophagus, a
dyspnea, persistent vomiting and purging, a ra
pulse, and the symptoms of collapse. The mind
clear until the end, but coma often precedes
intense irritation of the throat sometimes causes
larynx, in consequence of which death may re
minutes from asphyxia.

**Treatment.**—The ammonia should be neutra
administration of some weak acid, such as vine
quently the inflammation should be allayed by
and opium. Asphyxia from laryngeal edema
tracheotomy.

**Therapeutics.**—Ammonia is employed chiefl
acting cardiac and respiratory stimulant, as an an
tric acidity, and as a counter-irritant.

In *syncope, collapse*, and other forms of *sudden*
ammonia is an invaluable stimulant. In *gastralg*
*burn* dependent upon unnatural acidity of the s
tents, it is a useful antacid. As an antacid it is er
externally to neutralize the poison in the *bite*
*insects*. As a rubefacient, ammonia liniment
remedy in *chilblains*, *chronic rheumatism*, and *my*

**Administration.**—The spirits of ammonia
selected for internal administration. They shou
well diluted. For subcutaneous or intravenous i
monia-water is the most suitable preparation.
also used in various rubefacient liniments. Strong
water, applied on a pledget of cotton, covered w
crystal, has been used as a vesicant, but the pr
painful and the blister is slow in healing.

**Incompatibles.**—Ammonia is incompatible
and vegetable acids, chloral, and alkaloids. With
corrosive sublimate it forms the insoluble amm
cury. With solutions of ferric salts it forms the s
iron, which is the antidote to arsenic. With tinc
it yields a black precipitate of nitrogen iodid, whi
is very explosive. With solutions of formaldeh
urotropin.

### AMMONII CARBONAS, U. S. P.

(Ammonium Carbonate, $NH_4HCO_3.NH_4NH_2CO_2$.)

Carbonate of ammonium occurs in the form of white, translucent, crystalline masses having an extremely pungent odor and acrid taste. When exposed to the air it breaks up into a white powder—bicarbonate of ammonium. It is soluble in 4 parts of water. Its dose is 5–10 gr. (0.3–0.6 gm.).

**Physiologic Action and Therapeutics.**—Ammonium carbonate acts like ammonia, and is used for the same purpose, that is, to stimulate reflexly the medullary centers. It also shares with other ammonium compounds the property of rendering the bronchial secretion less viscid, hence it is frequently employed as an expectorant. It is particularly efficacious in *acute pulmonary diseases* associated with cardiac and respiratory weakness, such as severe bronchitis, bronchopneumonia, and croupous pneumonia.

**Administration.**—To guard against excessive gastric irritation, it is usually prescribed in mucilage or syrup of acacia, as in the following formula:

℞ Ammonii carbonatis, ʒij (8.0 gm.);
Pulveris acaciæ et sacchari, aa q. s;
Tincturæ lavandulæ compositæ, fʒij (8.0 c.c.);
Aquæ, q. s. ad fʒiij (90.0 c.c.).—**M.**
Sig. A teaspoonful in water every two or three hours.

**Incompatibles.**—The same as the preparations of ammonia. Ammonium carbonate cannot be prescribed with syrup of squill, syrup of citric acid, or syrup of ipecac, or other syrups of acid reaction.

### ALCOHOL, U. S. P.

(Ethyl Alcohol, $C_2H_5HO$.)

Ethyl alcohol is obtained from the distillation of fermented saccharine material. The official preparation contains 92.3 per cent. by weight of absolute ethyl alcohol, and appears as a colorless, inflammable liquid, having a pungent odor and a burning taste.

PREPARATIONS.

Alcohol Absolutum, U. S. P. (99 per cent. alcohol).
Alcohol Dilutum, U. S. P. (41.5 per cent. absolute alcohol).
*Spirits:*
Spiritus Frumenti, U. S. P., or whisky (37 to 47.5 per cent. alcohol), distilled from fermented grain.
Spiritus Juniperi Compositus, U. S. P., equivalent to gin (about 60 per cent. alcohol).
Spiritus Vini Gallici, U. S. P., or brandy (39 to 47 per cent. alcohol), distilled from fermented grapes.

*Malt Liquors:*

Ale, Beer, Porter, } obtained from the fermentation of malted grain, and co 6 per cent. alcohol.

*Wines:*

Vinum Album, U. S. P., or white wine (7 to 12 per cent. alcoh
Vinum Rubrum, U. S. P., or red wine (7 to 12 per cent. alcohol
Vinum Portense, or port wine (15 to 20 per cent. alcohol).
Vinum Xericum, or sherry wine (15 to 20 per cent. alcohol).
The official wines are made by fermenting the unmodified juice

**Physiologic Action.—Circulatory System.**— action of alcohol on the circulation is still obscure. doses cause acceleration of the pulse and flushing face, without materially augmenting the blood-pre acceleration of the pulse is due (1) in part to mental cal excitement, (2) in part to reflex stimulation f irritation, and probably also (3) in part to a direct a and transitory, on the nervous or muscular mecha heart itself. The flushing of the surface is caused b of the peripheral vessels from depression of the centers. The vessels of the splanchnic area appar share in the dilatation; indeed, there is some reason f that they are slightly constricted.

While alcohol increases the amount of blood pur heart in a given length of time (Wood and Hoyt), it do under ordinary conditions any material change in pressure, probably because the actions of the drug i the heart power and in widening the peripheral about equally balanced. It is generally admitte that very large amounts of alcohol produce a notab arterial pressure through depression of the vas centers and the heart muscle.

**Nervous System.**—The first effect of alcoho nervous system is one of apparent stimulation, with of increased mental and motor activity. As a ma however, attention, self-control, judgment, and the hi processes generally, as well as the capacity of the in physical work, are distinctly impaired at once by quantities of the drug, and, therefore, the vivacity of excess of motor energy often displayed in the ea alcoholic intoxication must be attributed rather to a of the inhibitory or controlling functions than to a lation of the higher cerebral centers.

With a very large dose of alcohol the stage of e soon followed by one of paralysis, which is chara loss of memory, thick speech, ataxia, lessened reflex and somnolence, gradually deepening into coma.

**Respiration.**—Moderate amounts of alcohol slightly quicken the respiration and increase the amount of air inhaled. These effects are probably produced reflexly by irritation of the stomach, as there is no evidence to show that the drug is a direct respiratory stimulant. Failure of respiration is the usual cause of death in fatal alcoholic poisoning.

**Alimentary Canal.**—Alcohol augments the flow of saliva and gastric juice, quickens peristaltic movements, and accelerates absorption. Very small amounts (less than 2 per cent.) favor peptic digestion, while large amounts (more than 10 per cent.) distinctly retard it. Large doses of concentrated alcohol produce acute gastritis.

**Effect on Metabolism.**—Moderate amounts of alcohol undergo combustion in the body, spare to a certain extent the oxidation of fats and proteids, supply energy to the tissues, and serve to maintain the body-weight, when, for any reason, the diet is insufficient. To this extent alcohol is a food.

**Temperature.**—Alcohol lowers the body temperature to a slight extent by dilating the skin-vessels, and so allowing an undue loss of heat. Accompanying the fall of temperature a sensation of warmth is experienced, which is also due to the increased amount of blood in the skin.

**Elimination.**—In moderate doses alcohol undergoes complete oxidation in the body, only a small amount (1 or 2 per cent.) being eliminated unchanged by the kidneys and lungs. The products of its decomposition are carbon dioxid and water.

**Local Action.**—Concentrated solutions withdraw water from the cells and precipitate albumins, and thus produce decided irritation. When applied to skin in dilute form and allowed to evaporate, it abstracts heat and produces a sensation of coldness.

**Action on Lower Organisms.**—Alcohol possesses moderate germicidal properties. According to the researches of Harrington and others the best results are obtained with alcohol of 60 per cent. strength, its germicidal power diminishing with departures in both directions from this dilution.

**Toxicology.**—The ingestion of large quantities of alcohol produces the following symptoms: Flushing of the face, mental excitement, quickening of the pulse and respiration; then incoherent speech, delirium, dilated pupils, loss of co-ordination, subnormal temperature, vomiting, and, finally, stupor and coma. Not infrequently the coma is interrupted by convulsive seizures. In most cases, if the dose has not been too large, recovery follows in a day or two.

Care must be taken to distinguish acute alcoholism from

uremia, opium-poisoning, and apoplexy. The u
of the breath, the accentuation of second aortic
small pupils, and the presence of albumin in th
serve to distinguish *uremia*. The small pupils, sl
tion, and slow pulse will indicate *opium-poiso*
unequal pupils, hemiplegia, and elevated tempe
serve to separate *apoplexy* from alcoholism.

**Treatment.**—The stomach should be empti
stomach-pump, a stimulating emetic, or the hyp
jection of apomorphin (gr. $\frac{1}{10}$—0.007 gm.). If
weakens, stimulants like strychnin, ammonia,
should be administered hypodermically.

**Chronic alcoholism** is characterized by distu
fine tremors, mental impairment, injection of the ey
of the nose, and the symptoms of gastro-intesti
When the habit is long-continued, degenerative ar
changes in the heart, blood-vessels, liver, and kidn
to develop.

A common complication of chronic alcoholism
*tremens*, which is generally excited by temporary
injury, or some acute intercurrent disease, espec
monia. It is manifested by great mental excitem
nia, incoherent speech, tremors, disordered intellec
fying hallucinations of sight or hearing. The pu
and feeble, the appetite is lost, the bowels are const
the temperature slightly elevated. In favorable
valescence follows in a few days, but not infrequen
symptoms develop and the attack ends in death.

Among other sequels of dipsomania may be
pneumonia, chronic meningitis, multiple neuritis,
epilepsy, and dementia.

**Treatment of Delirium Tremens.**—As there h
been a complete abstinence from food during th
leading to the delirium, nutritious foods are always
and the best are milk with lime-water and highl
beef-tea. Sleep must be secured by chloral (gr. xx
hyoscin (gr. $\frac{1}{100}$—.00065 gm.), potassium bromid (ʒj
or paraldehyd (fʒss–fʒj—2.0–4.0 c.c.). Sir William
has found cold affusions, followed by vigorous r
great service in promoting sleep. Active catharsis
encouraged. When the pulse is weak, strychnin ar
will be found useful stimulants. Subcutaneous in
normal salt solution are sometimes very effective.
cases physical restraint will be required; it may be
strapping the patient to the bed with sheets. Shoul

stupor develop, the application of a blister to the back of the neck or a few light touches of the actual cautery will often serve to arouse the patient.

**Therapeutics.**—Alcohol is employed internally as a diffusible circulatory stimulant, a stomachic, a food, and a chemical antidote. Externally it is used as an antiseptic, a stimulant, a hemostatic, and an antihydrotic.

In all forms of sudden heart-failure, as in *syncope*, *shock*, *snake-bite*, and *acute febrile disease*, alcohol is an invaluable stimulant. In the continued fevers, like *typhoid*, it fills a triple rôle: it serves as a food, as a general stimulant, and as a promoter of digestion. In these cases, however, it is well to withhold it until the pulse flags or the heart-sounds indicate a weakening of the circulation. Brunton's rule for administering alcohol is a good one: "Sit by the side of your patient for a while and watch him after the administration of a dose of alcohol, and if you find that the alcohol brings back the various functions nearer to the normal, then it is doing good; if the functions of the organs diverge further from the normal after the administration of alcohol, then it is doing harm."

In chronic diseases, like *phthisis*, *obstinate atonic dyspepsia*, and *valvular affections of the heart*, it often does good, but it should be administered tentatively, with due regard for the danger of producing chronic alcoholism.

The power which alcohol possesses of counteracting the escharotic action of carbolic acid was first pointed out by Phelps and Powell in 1899. Since then sufficient evidence has accumulated to warrant the belief that alcohol, when administered promptly, is a valuable *antidote in carbolic-acid poisoning*. From 1 to 3 ounces of diluted alcohol should be poured into the stomach through a tube, and lavage immediately practised with water containing a soluble sulphate.

**External Uses.**—Bathing with alcohol is a useful adjuvant to other measures in disinfecting the skin. A mixture of alcohol and water makes a useful evaporating lotion in the treatment of contusions with ecchymosis. Applied to wounded surfaces it is effective in controlling capillary oozing. Sponging the body with alcohol and water is often servicable in checking the night-sweats of phthisis.

## DIGITALIS, U. S. P.

(Foxglove.)

Digitalis is the dried leaves of *Digitalis purpurea*, a biennial herb growing in Central and Southern Europe. It contains several principles, all of which are probably of the nature of

glucosids, the most important being *digitoxin*, *digitalin*, *digitalein*, *digitonin*, and *digitin*. The fi cardiac stimulants and vasoconstrictors, and repres less imperfectly the virtues of the crude drug. D member of the saponin group and is not absorb alimentary canal. By its presence, however, the cosids, which are insoluble in water, are held in when an infusion is made of the leaves. Digitin is

| PREPARATIONS. | Dos |
|---|---|
| Tinctura Digitalis, U. S. P. . . . . | 5–20 min. (0.3 |
| Fluidextractum Digitalis, U. S. P. . . . | 1–2 min. (0.06– |
| Infusum Digitalis, U. S. P. . . . . | 1–4 fl. dr. (4.0– |
| Extractum Digitalis, U. S. P. . . . . | $\frac{1}{6}$–$\frac{1}{4}$ gr. (0.010– |
| Pulvis Digitalis . . . . . | $\frac{1}{2}$–2 gr. (0.032–0 |
| Digitalin (an amorphous powder, extremely variable in composition) . . . | $\frac{1}{60}$–$\frac{1}{30}$ gr. (0.00 |
| Digitaline Cristalliseé, or Nativelle's digitaline (impure digitoxin) . . . . | $\frac{1}{250}$–$\frac{1}{60}$ gr. (0.00 |
| Digitalinum Germanicum (a mixture of glucosids, soluble in water and alcohol; suitable for hypodermic use) . . . . | $\frac{1}{80}$–$\frac{1}{20}$ gr. (0.001 |

**Physiologic Action.—Circulatory System.**—nant action of digitalis is on the circulation. In *doses* it slows the pulse and raises the blood-pre slowing of the pulse is due mainly to stimulation (prolonged diastole), but partly to the action of the cardiac muscle (prolonged systole). The increa pressure is due (1) to more complete and forcible of the ventricle and (2) to constriction of the periph The vasoconstriction is mainly the result of the d of the drug on the muscle of the arterioles, but it duced by stimulation of the vasomotor center.

The action of digitalis on the vagi is antagonistic on the cardiac muscle. The tendency of the inhibit to cause disastolic slowing and less complete systol of the muscular action is to cause more comple longed systolic contraction (systolic slowing) and le diastole. Nevertheless, the sum of these effects is in the total output of the heart per unit of time; fo the slowing of the heart tends to decrease the out crease is more than compensated for by the increa of blood that enters the ventricle because of the lon and leaves it because of the stronger systole.

In the *first stage of the poisoning* the pulse becom irregular, and the output of the heart per minute was before the administration of the drug. This ef

ascribed to excessive inhibitory stimulation. In the *second stage of poisoning* the pulse becomes rapid and still more irregular. The output of the heart per minute varies. For a time it may be increased in consequence of the greater number of ventricular contractions, but soon it falls off, owing to the imperfect relaxation of the ventricle. Finally, the heart passes in fibrillary contractions and stops in diastole. The phenomena of the second stage of poisoning by digitalis are to be ascribed to increased irritability of the heart muscle.

It has been shown that decided hypertrophy of the heart can be induced in animals by giving them digitalis in small doses for a prolonged period.

**Local Action.**—Digitalis is intensely irritant, and when applied to mucous membranes causes smarting, redness, and swelling. Of the glucosids, digitoxin is the most irritant and digitalin the least.

**Alimentary Canal.**—Large doses of the drug frequently excite nausea, vomiting, and diarrhea.

**Nervous System.**—The medulla appears to be the only part of the central nervous system influenced by digitalis. Even in therapeutic doses the drug stimulates the inhibitory cardiac and the vasoconstrictor centers. Toxic doses increase the depth and rate of the respirations and sometimes cause convulsions. It is possible that the vomiting, which follows the exhibition of large doses of the remedy, is partly of central origin.

**Kidneys.**—In health digitalis has but little diuretic action, but when the urine is scanty from low arterial tension, it induces free diuresis. It may, therefore, be assumed that the drug has little or no direct influence on the renal epithelium, but that it indirectly increases the quantity of urine through its action on the heart and blood-vessels. The elimination of digitalis is effected very slowly.

**Toxicology.**—Digitalis-poisoning is characterized by obstinate vomiting, diarrhea, headache, disordered vision, and a very slow full pulse. The pulse, however, often becomes suddenly rapid and feeble when the patient sits up. Later, even in recumbency, the pulse becomes rapid, irregular, and thready, the urine scanty or suppressed, the surface cold, and the mind cloudy. Intelligence, however, is not lost until shortly before death. Occasionally convulsions develop during the last stage.

The uninterrupted use of digitalis in full doses is sometimes followed by the sudden appearance of toxic symptoms; this untoward effect seems to be due to the *cumulative action* of the drug, and is especially liable to occur when there is no



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diuretic effect, and after the removal of serous
paracentesis. In the first instance elimination
with, and in the second, absorption is effected
rapidity. The earliest manifestations of this
usually irregularity of pulse, precordial distre
appearance of the heart-beats in couples, the fi
only can be detected at the wrist. When a prolc
the remedy is required, it should be suspended at
a definite period, so as to allow of complete elimi

**Treatment of Poisoning.**—The patient must b
recumbent position. Emetics or purges may be r
the removal of any part of the poison that is still
Tannic acid should be administered as a chemical
is important to maintain the body-temperature by
tion of external heat. Alcoholic stimulants may
Aconite has been recommended on theoretic g
physiologic antidote, but it should be used with
caution.

**Therapeutics.**—Digitalis fills three importar
serves as a powerful cardiac stimulant; it slows tl
regulates its rhythm, and it acts as a diuretic.

**As a Cardiac Stimulant.**—Digitalis is especia
when there is simple dilatation of the heart. By
diastole it rests the heart and allows the ventricle
more completely filled; and by strengthening tl
aids in the more thorough emptying of these ch
combined action tending to readjust the inequ
arterial and venous circulations. Moreover, by f
blood into the coronary arteries, digitalis may per
fluence for good the tone of the heart muscle.

Hypodermic injections of digitalin are often usefu
in *collapse* from various causes, and in *poisoning*
depressants.

In *chronic valvular disease with symptoms of fai*
*sation* digitalis is often of the utmost value, but it
used indiscriminately. The chief indications for
dropsy, deficient urination, and a rapid, weak, a
pulse. When cardiac hypertrophy overbalances di
the symptoms of arterial hyperemia exist, its ad
will be productive of harm.

The best results are seen in *mitral regurgitat*
disease digitalis secures a more perfect closure o
valves by causing a more vigorous contraction of
surrounding the orifice; moreover, it supports th
tricle, which is subjected to a severe strain on ac

increased resistance in the pulmonary circuit. In some cases of mitral regurgitation, digitalis, although apparently indicated, fails to afford relief because of the existence of pericardial adhesions or of advanced degeneration of the myocardium. When the right ventricle is much distended and the evidences of venous stasis are marked, the drug may fail to act until the tension in the veins has been lessened by the abstraction of a few ounces of blood.

In *mitral stenosis* digitalis is far less serviceable than it is in mitral regurgitation. It should be used only when, as the result of a failing right ventricle, dropsy and anuria are present. Theoretically, by strengthening the contractions of the right ventricle, and by lengthening diastole, so allowing a longer time for blood to enter the left ventricle through the constricted orifice, it should be effective in lessening venous stasis, but unfortunately, in many cases of mitral stenosis, there is extensive disease of the myocardium, and in the presence of the latter—which in all forms of endocarditis is more important than the mere mechanical defect in the valve—digitalis is often useless or harmful.

In *aortic stenosis* digitalis is rarely indicated, and used injudiciously it may provoke serious injury. When, however, there are symptoms of back-pressure in the lungs, with dropsy, it may be employed with advantage.

The existence of *aortic regurgitation* is not necessarily a contraindication to the employment of digitalis. It is true that by prolonging diastole regurgitation is favored, but under certain conditions the drug more than compensates for this drawback by strengthening the contractions of the ventricle, and by improving the tone of the myocardium. It should be withheld when the pulse is slow, full, and regular, but when the pulse becomes rapid, weak, and irregular, and symptoms of venous stasis appear, it may be administered tentatively.

In *tricuspid regurgitation* not dependent upon disease of the valves, but due to simple dilatation of the right ventricle, digitalis is sometimes effective, but when used too freely it may excite, as Potain has observed, pulmonary hemorrhage.

In *advanced fatty degeneration* digitalis often entirely fails or acts unfavorably, but in the early stages of the disorder the exhibition of minute doses, as recommended by Balfour, is often followed by gratifying results. In these cases it is nearly always necessary to counteract the constricting effect of the drug on the arterioles by giving with it some vasodilator, like nitroglycerin, sodium nitrite, or potassium iodid. When symptoms of *angina pectoris* are present, digitalis must be used with extreme caution, but even here small doses are some-

times of value in the intervals between the attac
cially after severe attacks, when symptoms of c
present themselves.

In *pneumonia*, when there is failure of the rig
its efforts to drive blood into the partially cons
and in consequence the pulse becomes rapid an
talis often causes a decided improvement in th
In such cases it has seemed to us to be more e
given hypodermically.

**As a Vagus Stimulant.**—In Graves's disease d
times quiets the heart and lessens the pulse-rate,
its action is disappointing, and in not a few cas
borne. In the *irritable heart* resulting from ove
*arhythmia* dependent upon simple dilatation, it is
service, but in *nervous palpitation* and *paroxysm*
it rarely affords relief.

**As a Diuretic.**—We regard digitalis as the
remedy we possess in *cardiac* and *renal drop*
results are obtained when the pulse is soft a
*hepatic dropsy*, in common with other diuretics, i
useless. In *pleural effusion* and in other inflamm
dations it is rarely of value.

**Contraindications.**—Digitalis is contraindic
rysm, advanced degeneration of the myocardiu
developed atheroma.

**Administration.**—For general use the tinctu
reliable preparation; as a diuretic, however, son
infusion. When digitalis is not well borne by th
when a prompt action is desired, digitalin may be
dermically. When it is desirable to give the dru
the powdered leaves or the extract will be foun
In *cardiac* or *hepatic dropsy* it may be advanta
bined with mercury, as in the well-known Nieme

℞ Pulveris digitalis,
Pulveris scillæ,
Massæ hydrargyri, āā gr. xx (1.3 gm.).
Fiant pilulæ, No. xx.
Sig. One thrice daily after meals.

In renal dropsy the following combination of
juniper and potassium acetate is well thought of

℞ Junip. contus., ℥x (40.0 gm.);
Pulv. scillæ, ℥j (30.0 gm.);
Pulv. digitalis, ℥j (4.0 gm.);
Vin. xerici, Oj (½ liter).
Macerate for four days and add:
Potass. acetatis, ℥iij (12.0 gm.
Express and filter.
Sig. Tablespoonful three times a day.

Patients taking digitalis should be seen at frequent intervals, on account of the suddenness with which untoward symptoms may develop during its administration. When large doses are being used it is essential that the patient should be confined to bed. While some patients can take small doses of digitalis with advantage for long periods without interrupting the treatment, it nevertheless is advisable in most cases to suspend the administration every six or seven days for a like period, employing in the interval some alternate, such as caffein, strophanthus, or convallaria.

**Incompatibles.**—Digitalis is incompatible with preparations containing tannic acid. With iron salts it forms an inky mixture.

## STROPHANTHUS, U. S. P.

Strophanthus is the seed of *Strophanthus Kombé*, a native of Africa. It contains a glucosid, *strophanthin*, which represents, in a measure, the therapeutic properties of the drug. This principle appears as a white, amorphous, or crystalline powder, of an intensely bitter taste, and soluble in water and alcohol.

| Preparations. | Dose. |
|---|---|
| Tinctura Strophanthi, U. S. P. . . . . | 3–10 min. (0.18–0.65 c.c.). |
| Strophanthinum, U. S. P. . . . . | $\frac{1}{100}$–$\frac{1}{50}$ gr. (0.0006–0.0013 gm.). |

**Physiologic Action.**—Strophanthus has an action very similar to that of digitalis; like the latter, it slows the pulse, stimulates the heart, raises the blood-pressure, and increases the flow of urine. There are, however, certain points of difference in the action of the two drugs: (1) Strophanthus constricts the vessels of the splanchnic area, but has little or no action on the peripheral vessels; (2) it is diuretic even in normal animals, probably because it is without influence on the renal arteries; (3) it is a more powerful muscle poison than digitalis; (4) it is absorbed more rapidly than digitalis, and, in consequence, is less irritant to the stomach; (5) it is eliminated more rapidly than digitalis, and, therefore, its action is less likely than that of the latter to become cumulative.

**Therapeutics.**—Strophanthus is a valuable cardiac tonic, and may be employed in the class of cases in which digitalis is indicated; it is more prompt in its action, but, as a rule, it is less reliable than the latter. It may be recommended whenever the older remedy fails, or is not well borne, or when an alternate is desired.

**Contraindications.**—The contraindications to the use of strophanthus are the same as those referred to in connection with digitalis.

## CAFFEINA, U. S. P.

(Caffein.)

Caffein is an approximate principle obtained fr
of *Thea sinensis*, or from the seeds of *Coffea ar*
pears in the form of colorless, fine, silky cryst
bitter taste and a neutral reaction, and soluble
parts of cold water. The drug is freely soluble i
sodium benzoate and sodium salicylate.

| PREPARATIONS. | DOSE |
|---|---|
| Caffeina Citrata, U. S. P. . . . . | 2–5 gr. (0. |
| Caffeina Citrata Effervescens, U. S. P. . . . . | 1–2 dr. (4. |
| Caffeinæ Sodio-benzoas (45 per cent. of caffein), | 5–10 gr. (0 |

**Physiologic Action.—Circulatory System.**
of caffein on the circulation are more or less a
one another. The drug tends to increase the rat
by acting directly on the heart-muscle, and to d
stimulating the inhibitory center in the medul
Again, it tends to raise the arterial pressure (1)
the efficiency of the heart itself, and (2) by stimula
motor center (vasoconstriction); on the other ha
lower the arterial pressure by directly dilating, to
the peripheral vessels. The total effect of therap
generally to increase the rate of the heart and,
the output of blood per unit of time.

After very large doses the contractions follow
rapidly that the ventricle has not time to fill, the b
falls, *delirium cordis* ensues, and the heart stops i

**Nervous System.**—Caffein is a powerful cereb
ulant. In man the cerebrum is first affected, then
and, lastly, the spinal cord. Even small doses in
activity, quicken perception, induce wakefulness
fatigue. In the medulla the drug stimulates not c
motor and cardio-inhibitory centers but also th
center. Its effects on the spinal cord are seen
only after the administration of relatively large
are indicated by an increase in the reflex excitab
occurrence of tetanic convulsions.

**Muscles.**—Small amounts of caffein increase b
bility and working power of all forms of mu
amounts bring about a condition of rigor, which
the fibers becoming contracted, hard, and opaque

**Respiratory System.**—Caffein is a powerful

the respiratory center. Under its influence both the number and depth of the respirations are increased.

**Kidneys.**—Under favorable conditions caffein increases very decidedly the secretion of urine. The increase involves the output of water to a much greater extent than that of the solids, hence the specific gravity of the urine falls. Caffein diuresis is, probably, due to a direct stimulation of the renal epithelium, though some pharmacologists ascribe it to a dilatation of the renal arterioles of peripheral origin. It is certainly not the result of any changes in the general circulation.

**Alimentary Canal.**—Caffein is rapidly absorbed, and, except in very large doses, is without action on the alimentary canal.

**Elimination.**—Only a small quantity of the caffein ingested is secreted in the urine unchanged. To a great extent the drug is eliminated as di- and mono-methylxanthins. A very small amount is oxidized to urea.

**Toxicology.**—The characteristic symptoms of caffein-poisoning are mental excitement followed by delirium, palpitation, rapid breathing, frequent urination, intestinal colic, numbness of the extremities, tremors, convulsions, and, finally, collapse.

**Therapeutics.**—Generally speaking, caffein is a far less useful remedy in *valvular heart disease* than digitalis. When there is marked *dropsy*, however, a combination of caffein and digitalis often acts more favorably than either drug alone. In combating cardiac insufficiency in *pneumonia* and other *infective* processes, it is usually more effective than digitalis.

Being a direct diuretic, it often affords relief in *chronic parenchymatous nephritis with dropsy*, when digitalis fails. In *chronic interstitial nephritis*, when the left ventricle dilates and, in consequence, the secretion of urine falls off, dyspnea develops, and dropsy appears, it is sometimes serviceable. In *acute pulmonary edema* a combination of caffein and atropin may have a very happy effect, especially if administered hypodermically.

As a respiratory stimulant it is valuable in *poisoning by opium* and other drugs which depress the respiratory center. In combination with phenacetin or one of the bromids it will often afford relief in *migraine* and *headache from nervous strain.*

**Contraindications.**—It is contraindicated in all conditions associated with troublesome insomnia. In some persons even small doses, when administered late in the day, cause wakefulness at night.

**Administration.**—Since caffein and citrated caffein are readily decomposed in the presence of water, they are generally prescribed for internal use in pills, powders, or capsules. When a prompt action is desired the drug should be given

hypodermically, and for this purpose the sodi
caffein, as it is freely soluble and quite stable in
be found a suitable preparation. The following
illustrate the method of prescribing caffein:

℞ Caffeinæ citratæ, gr. xxiv (1.6 gm.);
Acetanilidi, ʒj (4.0 gm.).—M.
Fiant chartulæ, No. xii.
Sig. One every two hours. (In *nervous headache.*)

℞ Caffeinæ, gr. xlviii (3.0 gm.)
Sodii benzoatis, ʒij (8.0 gm.).—M.
Fiant chartulæ, No. xii.
Sig. One every four hours. (In *chronic nephritis with dropsy*

℞ Caffeinæ sodio-benzoatis, gr. xij (0.8 gm.);
Aquæ destillatæ, ʒj (4 c.c.).—M.
Sig. 20 minims = 4 grains, or 1 c.c. = 0.2 gm.

## CONVALLARIA, U. S. P.

(Lily of the Valley.)

Convallaria is the rhizome and roots of *Convall*
It contains two glucosids, *convallarin* and *convalla*
Convallarin, being a saponin (see p. 19), is n
from the alimentary canal, and, therefore, the value
as a cardiac stimulant depends chiefly upon the co

| Preparations. | Dos |
|---|---|
| **Fluidextractum Convallariæ, U. S. P.** . . | 5–20 min. (0.3– |
| Convallamarin . . . . . | ½–1 gr. (0.03–0. |

**Physiologic Action and Therapeutics.**—
obtained from the study of the physiologic actio
laria are somewhat conflicting, but clinical experie
that it acts much like digitalis in stimulating th
increasing the flow of urine. It has the advant
having any cumulative effect, and of not disturbin
ach. Most authorities, however, agree that, as
action is inferior to that of digitalis, but that it som
excellent results in cases in which the latter
failed. Its best effects are seen in the *dropsy of he*
**Administration.**—Convallaria should be pre
in the form of the fluid extract, since the conva
commerce is a variable product.

## ADONIDIN.

Adonidin is a glucosid obtained from the *Adoni*
perennial plant indigenous to Central Europe and
an amorphous, yellow or brown, odorless powde

intensely bitter taste. It is soluble in water and alcohol. The dose is from $\frac{1}{12}$–$\frac{1}{4}$ gr. (0.005–0.01 gm.).

**Physiologic Action.**—Adonidin affects the circulation somewhat like digitalis. It slows the pulse, probably by stimulating the vagi, and increases the arterial pressure probably by stimulating both the heart and the vasomotor center. Its action is more prompt than that of digitalis, but not so powerful. It does not seem to have any cumulative action. When the arterial pressure is low, adonidin causes some increase in the quantity of urine, but the drug apparently exerts very little influence on the kidney itself. Overdoses may cause nausea, vomiting, and diarrhea.

**Therapeutics.**—Adonidin is used in about the same class of cases as digitalis. While generally less reliable than digitalis, it may be employed as a substitute when the older remedy is badly borne or is ineffective. Oliver speaks favorably of its action in *aortic regurgitation.*

## OTHER CIRCULATORY STIMULANTS.[1]

**Ether** (see p. 118).—In ordinary doses ether by the mouth or skin has little direct action on the heart, but through its local irritant effects it reflexly quickens the pulse and slightly raises the blood-pressure. On account of the promptness of its action it is a useful remedy in *sudden heart-failure*, as in shock, poisoning, and collapse of cholera, and other infections. In these cases it may be given hypodermically in doses of from 15–30 min. (1.0–2.0 c.c.).

**Nitrites.**—Nitroglycerin, amyl nitrite, sodium nitrite (see p. 69) affect the circulation in a similar manner, but differ in the rapidity and duration of their action, that of nitrite of amyl being the most rapid, but the least persistent, and that of sodium nitrite being the least rapid, but the most persistent. They quicken the pulse by stimulating the vagus center in the medulla oblongata and lower the blood-pressure by depressing the muscle of the arteries and thus causing vasodilation. The value of these drugs in diseases of the circulatory system is not due to their action on the heart itself, but to the relief they afford to the heart in diminishing the resistance in the peripheral vessels. They are especially useful in *valvular diseases*, when there is precordial distress and increased pulse-tension. When there is *myocardial degeneration* they may be combined advantageously with small doses of digitalis, in order to counteract the constricting effect of the latter on the blood-vessels. The

[1] The properties of these drugs are more fully considered under other headings.

dyspnea, headache, and precordial discomfort att
*chronic nephritis* with arteriosclerosis are often
nitrite. Inhalations of amyl nitrite are exceeding
in the paroxysms of *angina pectoris*.

When a very prompt action is desired, nitrite
5 drops) may be given by inhalation. Nitrogly
given in the form of the official 1 per cent. alcoh
the dose of which is 1–2 min. (0.06–0.1 c.c.
increased, or in the form of tablets containing a
$\frac{1}{200}$–$\frac{1}{50}$ gr. (0.0003–0.001 gm.).

On account of the marked variation in individ
bility small doses should be administered at fir
gradually increased until the limit of tolerance is

**Camphor** (see p. 132).—Camphor is a useful
diac stimulant in *adynamic fevers*. It not on
strengthen the pulse, but it also acts favorably in
restlessness and delirium. It is best given hypo
doses of ½–2 gr. (0.03–0.13 gm.), dissolved in steril

**Squill** (see p. 224).—Squill closely resembles
its action on the circulation. It is also an effic
acting partly by increasing the quantity of bl
through the kidneys and partly by directly sti
renal epithelium. Its irritant effect on the stoma
is especially pronounced, and for this reason it wa
used in large doses as an emetic. In smaller
favorite expectorant.

In *valvular heart disease* it is chiefly employed
vant to digitalis when there is persistent *dropsy*.
the combination of blue mass, powdered squill,
known as Niemeyer's Pill (see p. 52), is commonl
Owing to its expectorant properties, squill is freq
cious also in *chronic bronchitis* with *emphysema*
*right heart*.

**Apocynum** (see p. 225).—This drug has the san
action as digitalis, but as it is more irritant to the
intestines than the latter, it is less serviceable
stimulant. The fluidextract is sometimes given
from 5 to 10 min. (0.3–0.6 c.c.) in *valvular disease*
is much *dropsy*.

**Cactus Grandiflorus.**—This drug has been
a number of years as a substitute for digitalis in v
tional and organic diseases of the heart. The
evidence, however, does not support the view t
digitalic action, nor are clinicians in accord as to its
value. It is usually prescribed in the form of a

made of the fresh plant, the dose of which is from 10 to 30 minims (0.60–2.0 c.c.).

**Adrenalin** (see p. 66).—When injected directly into a vein, adrenalin slows the pulse and causes a marked increase in the blood-pressure. The first of these effects is due chiefly to stimulation of the cardio-inhibitory center in the medulla, and the second, partly to the direct action of the drug on the heart itself and partly to its powerful constricting effect on the peripheral vessels. These effects of adrenalin on the circulation are prompt but evanescent, and are pronounced only when the drug is given intravenously. Administered in this way (1 part of adrenalin chlorid to 50,000 parts of normal salt solution) it is sometimes useful in maintaining the arterial pressure in *shock* and *collapse*, the result of severe injury or operation.

**Strychnin** (see p. 141) in full medicinal doses raises the arterial pressure by stimulating the vasomotor center in the medulla. This action, together with its influence on the respiration, digestion, and muscle tonus, renders it a valuable remedy in combating certain forms of circulatory depression. Administered hypodermically, it is of considerable benefit in *surgical shock*. In *simple dilatation of the heart*, with or without valvular disease, it is often of the greatest service as an adjuvant to digitalis. In *pneumonia* and other *infective* processes it may prove more useful than digitalis. In the *weak heart of the old*, also, it is generally a better remedy than digitalis. In *chronic bronchitis* with *emphysema* it is indispensable in supporting the circulation and respiration.

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## CIRCULATORY DEPRESSANTS.

Circulatory depressants are drugs which lessen the activity of the heart. They decrease the output of the heart per unit of time. Some of them act by directly depressing the cardiac muscle. As samples of this group may be mentioned:

Chloral. Chloroform. Potassium salts.

Others act by stimulating the inhibitory mechanism of the heart. The most important members of this group are:

Aconite. Veratrum.

**Reduction of Blood-pressure.**—A drug may lower the blood-pressure (1) by decreasing the output of the heart per

unit of time (cardiac depressants and vagal stimul
decreasing the quantity of fluid in the vessels (ven
by decreasing the resistance in the peripheral v
dilators and purgatives).

**Reduction of the Pulse-rate.**—The action
may be slowed (1) by directly stimulating the inhibit
ism in the medulla (digitalis, aconite, veratrum); (
the blood-pressure and thus indirectly stimulating t
mechanism in the medulla (adrenalin, in part th
constriction). Depression of the excitomotor appa
also tend to lessen the frequency of the heart's
but no drug is known which in therapeutic doses h

The only drugs employed as circulatory dep
those which act by stimulating the vagal mechan
aconite and veratrum. These are indicated when t
the heart is unduly forcible. Thus they may be
sthenic fevers, in acute local inflammation, in valv
when there is excessive hypertrophy of the h
aneurism when the tension in the arteries is very h

## ACONITUM, U. S. P.

(Monkshood.)

Official aconite is the root of *Aconitum Napellus*
herb growing in Europe, Asia, and North America
is conical in shape, 2 or 3 inches long, brownish i
closely resembles horse-radish; from this, howeve
distinguished by its lack of pungent odor wh
When slowly chewed, it produces in the mouth
warmth and tingling, soon followed by numbness.

**Active Principle.**—The most important prin
nite is *aconitin* (aconitina, U. S. P.), a crystalline al
sparingly soluble in water, but more freely so in
and alcohol. The amorphous aconitin of com
mixture of alkaloids of variable strength, but m
than the official variety. The dose of crystalline
$\frac{1}{600}$–$\frac{1}{250}$ gr. (0.00011–0.00025 gm.).

| Preparations. | Dose. |
|---|---|
| Tinctura Aconiti, U. S. P. . . . . | 5–15 min. (0.3–1. |
| Fluidextractum Aconiti, U. S. P. . . . | 1–2 min. (0.06–0. |
| Linimentum Aconiti. | |

**Physiologic Action.**—Local Action.—Aconi
ous solution is not absorbed from the unbroken
rubbed in with fat, alcohol, or chloroform it prod

tingling sensation, then numbness, and, finally, anesthesia. From all mucous membranes it is readily taken up, so that the merest trace applied to the tongue induces almost immediately the characteristic tingling and numbness. Even when the drug is admininistered by the mouth or subcutaneously the same phenomena occur after absorption, chiefly, however, in the tongue, lips, throat, and finger-tips. This peculiar effect of aconitin on the skin and mucous membranes is the result of its selective action on the sensory nerve-endings. These are first stimulated and then paralyzed. Even in concentrated form the drug does not induce redness or other signs of inflammation.

**Circulatory System.**—From a therapeutic standpoint the dominant circulatory action of aconite is on the vagus. Moderate doses in mammals slow the pulse, lower the blood-pressure, and decrease the output of the heart per unit of time. These effects are the result of powerful stimulation of the inhibitory centers in the medulla. They can be prevented by section of the vagi and even by the application of atropin.

Toxic doses accelerate the heart's action, cause extreme auriculoventricular arhythmia, and finally bring on delirium cordis. These phenomena seem to be due to the direct action of the drug on the heart-muscle, since they occur after division of the vagi and also in the isolated heart. It is probable that aconite first stimulates and then depresses the vasomotor center. This action, however, is entirely overshadowed by that on the inhibitory cardiac mechanism.

**Effects of Aconite and Digitalis on the Circulation Compared.**—Both drugs in medicinal doses slow the heart by stimulating the vagus, but digitalis, owing to its very pronounced action on the vasomotor center, blood-vessel walls, and heart, raises the arterial pressure and increases the output of the heart per unit of time.

**Respiration.**—After large doses of aconite the breathing becomes slower, more labored, and sometimes dyspneic. These phenomena have been ascribed to broncho-constriction from stimulation of the vagal endings in the lungs, but in addition to this there appears some depression of the respiratory center, for ultimately death results from asphyxia.

**Nervous System.**—Apart from its action on the medullary centers, aconite does not seem to have any important influence on the central nervous system. The convulsions sometimes seen after toxic doses are probably the result of asphyxia. In poisoning the mind generally remains clear until near the end, though occasionally unconsciousness occurs early from col-

lapse. Certain other endings besides those of t
nerves, notably the motor endings in striped muscl
be excited by the drug.

**Secretions.**—It is doubtful whether aconite has
action on the nerve-endings of the secretory gl
excessive flow of mucus following the introduction
into the nostrils or mouth is excited reflexly by
the sensory nerve-endings, and the free perspiratio
in poisoning is probably the result of collapse.

**Digestive Tract.**—Toxic doses of aconite not r
nausea, vomiting, or purging. These are, no d
effects. Minute doses may allay vomiting by
the sensory nerve-endings of the stomach.

**Temperature.**—Aconite lowers temperature t
extent, both in health and in febrile states, but the
antipyretic action is not definitely known. It is bel
ever, that the drug has some influence on the heat
centers.

**Toxicology.**—The symptoms develop very ra
the injection of the poison. Among the first to ap
characteristic tingling, which, beginning in the lips, t
throat, soon spreads to the fingers and toes, and at l
the whole surface. This is accompanied by exces
tion, and sometimes by nausea, vomiting, and pur
pulse, at first infrequent and soft, later becomes ext
quent, weak, and irregular. The breathing is slow a
The skin is cool, livid, and covered with sweat. Th
usually clear until near the end, but sometimes ur
ness occurs rather early in consequence of the pro
lapse. Death, which is generally the result of
failure, is not rarely preceded by convulsions.

**Treatment.**—This consists in keeping the pati
recumbent posture, with the feet somewhat highe
head; in washing out the stomach, if necessary; in
tenance of the bodily temperature by external app
heat; and the administration hypodermically of
brandy, and atropin, especially of the latter, which
respects is antagonistic to aconitin.

**Therapeutics.**—In the early stages of acute
tions, such as *tonsillitis*, *pharyngitis*, *laryngitis*, and
and in the beginning of the *acute infectious disease*
*hood*, aconite is often very useful in quieting the circu
lowering the temperature. In *excessive hypertrop*
*heart* it sometimes acts favorably. In *acute cerebral*
with high arterial tension, it may be given in full

tachycardia and palpitation it is of little value unless these symptoms be associated with hypertrophy of the heart. Small doses (½ drop), at frequent intervals, are sometimes efficacious in *hyperemesis.* An ointment of aconitin (5–10 gr. to the ounce—0.3–0.6 to 30.0 gm.) was formerly much used as a local remedy in *neuralgia.* The liniment of aconite, official in the British Pharmacopœia, is often beneficial in *muscular rheumatism.*

**Administration.**—The tincture is the preparation most commonly selected for internal use; small doses should be given in water, frequently repeated, and the effect watched. Aconitin, on account of its pronounced toxicity, is rarely given internally. If used externally, care should be taken to avoid the eye, as the drug is highly irritating. On cutaneous surfaces, provided there are no abrasions, it may be applied with safety. The following time-honored combination is efficient in the mild febrile diseases of childhood:

℞ Tincturæ aconiti, ♏xv (1.0 c.c.);
Spiritus ætheris nitrosi, ʒvj (23.0 c.c.);
Liquoris ammonii acetatis, q. s. ad ʒiij (90.0 c.c.).—M.
Sig. A teaspoonful every two or three hours for a child of two years.

## VERATRUM, U. S. P.

(Green Hellebore or White Hellebore.)

Under one title, veratrum, the United States Pharmacopœia of 1900 recognizes the rhizome and roots of *Veratrum viride* and of *Veratrum album.* The former is a native of North America and the latter of Europe. While the action of the two plants is very similar, it is not known to be identical. White hellebore, the European variety, is apparently the more toxic of the two. Both plants contain a number of alkaloids. *Veratrin* appears to be the most active of those present in veratrum viride, and *protoveratrin* of those present in *Veratrum album,* though this is not certainly established.

The official veratrin is obtained from the seed of *Asagræa officinalis,* a bulbous herb growing in Mexico and Central America. It is a mixture of pure veratrin and a number of other less active alkaloids.

| Preparations. | Dose. |
|---|---|
| Tinctura Veratri, U. S. P. . . . . | 5–15 min. (0.3–1.0 c.c.). |
| Fluidextractum Veratri, U. S. P. . . . | 1–3 min. (0.06–0.2 c.c.). |
| Unguentum Veratrinæ, U. S. P. (4 per cent.). | |
| Oleatum Veratrinæ, U. S. P. (2 per cent.). | |

**Physiologic Action.**—Veratrum very closel aconite in most of its actions. In moderate doses a distinct slowing of the pulse, with some low blood-pressure. These phenomena are mainly at stimulation of the cardiac inhibitory center. Very after first slowing the pulse, suddenly accelerate i same time induce extreme arhythmia, with an enor blood-pressure. The acceleration of the pulse a due in part to paralysis of the peripheral vagi an stimulation of the cardiac muscle. The progressiv arterial pressure observed in late poisoning is ca pression of the vasomotor center and of the myoca

Like aconite, veratrum also depresses the res lowers the temperature.

**Special Action of the Alkaloids.**—Of th *veratrin* has a characteristic effect on muscle, b and unstriated. Under its influence, the muscle, v lated, contracts as rapidly as usual, but more vigo once contracted, requires from twenty to thirty time time to relax again. Further, the drug increases th of muscle and restores to some extent its contra this has been lost through fatigue. These effects to be due to increased catabolism. Like aconitin, v irritates and then depresses the sensory nerve-en local applications of the drug give rise in turn numbness, and anesthesia. Inhaled, it causes viole coughing, and increased secretion of mucus. Larg also paralyze the motor nerve-endings, but without them first. The vomiting and purging constantly veratrin-poisoning are probably produced reflexly of the sensory nerve-endings.

*Protoveratrin*, while it increases the strength o contractions, does not prolong the contractions, shortens them. It is even more depressant to sen endings than veratrin, but it has no paralyzant effe nerve-endings.

**Toxicology.**—Veratrum-poisoning resemble poisoning, but is generally marked by more sev intestinal symptoms.

**Therapeutics.**—In excessive *hypertrophy of the* or without valvular lesions, veratrum is a useful sedative. In *aneurism*, when there is much pain an is full and strong, veratrum, in conjunction with iodid and rest, often affords relief. In the beginni *inflammatory diseases* it may replace aconite as a ca tive and febrifuge.

In the first stage of *croupous pneumonia* of a sthenic type it may affect favorably the pulse and temperature, but it has no power of aborting the disease. In *puerperal eclampsia*, by lowering arterial tension, it often proves a valuable addition to other remedies.

Veratrin, in the form of the official ointment or oleate, is occasionally used as a local remedy in *neuralgia*. It should never be applied over large surfaces or where there are any abrasions, and in employing it about the face great care must be exercised to keep it out of the eye.

**Contraindications.**—Cardiac and systemic weakness and irritability of the stomach are the chief contraindications to its use.

**Administration.**—The tincture is the best preparation; it should be given at frequent intervals, the dose being cautiously increased until the physiologic effect is produced.

## OTHER CIRCULATORY DEPRESSANTS.

**Stavesacre.**—This drug (*Staphisagria*, U. S. P.) is the seed of *Delphinium Staphisagria*, an annual herb growing in Southern Europe. It contains several alkaloids, the chief of which is *delphinin*. The action of stavesacre is very like that of aconite, but the drug is rarely used at present except externally for the destruction of *pediculi*. For this purpose the oil diluted with 8 parts of olive oil or an ointment of the crushed seed (20 per cent.) may be prescribed. The United States Pharmacopœia recognizes a fluidextract of stavesacre, the dose of which is 1–2 min. (0.06–0.12 c.c.).

**Pulsatilla.**—This drug is the herb of *Anemone Pulsatilla* and *Anemone prætensis*. It contains a colorless, crystalline, acrid principle, known as *anemonin*. The dose of the latter is from $\frac{1}{6}$–$\frac{1}{2}$ gr. (0.008–0.03 gm.). The drug may be used also in the form of the tincture, the dose of which is 10–20 min. (0.6–1.2 c.c.).

Locally, pulsatilla acts as an irritant. Internally, large doses may cause vomiting and even purging. On the circulation its action is said to resemble that of aconite. Pulsatilla has been used as a circulatory sedative in acute inflammatory diseases, as a respiratory sedative in asthma, and as an emmenagogue, but as a therapeutic agent it is of little value.

## VASOCONSTRICTORS AND VASODILA

*Vasoconstrictors* are drugs that constrict the arterioles. They may act (1) by stimulating the center in the medulla or (2) by contracting the va directly. A number of them act in both ways. A having a central action may be mentioned:

Atropin. Caffein. Str

The following act both centrally and peripherall

Digitalis. Ergot. Co

The best example of a peripheral vasoconstricto

Adrenalin.

Vasoconstrictors raise the general blood-pressu increasing the tonus in the medulla, tend to les quency of the heart's action and to stimulate the As internal remedies they are especially indicated i of low arterial tension, such as shock and coll adrenalin, which is chiefly used as a vasoconstri considered in this chapter.

*Vasodilators* are drugs that dilate the peripher They may act (1) by depressing the vasomotor c medulla or (2) by relaxing directly the vascular most important are:

The nitrites.
The organic nitrates (nitroglycerin, erythrol tetr

These drugs act peripherally, and are employed the passage of the blood through the vessels a the arterial tension.

### ADRENALIN.

The remarkable action of suprarenal extract on tion, which was first pointed out by Oliver and 1894, depends upon the alkaloid isolated by Abel, variously known as *epinephrin*, *suprarenin*, and With acids the alkaloid forms salts, of which the h is freely soluble in water. This salt may be obtai

tals and in the form of a 1 : 1000 solution, preserved with some antiseptic.

**Physiologic Action.**—When injected into a vein, even in small doses, adrenalin causes marked elevation of the blood-pressure and slowing of the heart-beat. The first of these effects is due mainly to constriction of the arterioles, especially those of the splanchnic area, and in part to stimulation of the cardiac muscle. The retardation of the heart-beat is due to stimulation of the vagus center in the medulla oblongata, directly by the drug itself and indirectly by the rise of blood-pressure. The vasoconstriction is chiefly, probably entirely, of peripheral origin, and the result of a stimulant action exerted either on the muscle of the arterioles or the sympathetic nerve-endings in the muscle. As perfusion of adrenalin through vessels which are not innervated by the sympathetic, as those of the lungs and brain, does not cause constriction, it is probable that the drug acts on the nerve-endings rather than on the muscle-fibers themselves. These effects of adrenalin on the general circulation are pronounced only after intravenous injections; after subcutaneous injections they are very slight, even with large doses, and after administration by the mouth they are not noticeable. Even after intravenous injections they are very fugitive. The great variation in the action of the drug with these different methods of administration is to be ascribed to the slow absorption, on the one hand, and its rapid oxidation on the other. Locally, applied to mucous membranes or raw surfaces, it causes intense ischemia by directly constricting the peripheral vessels. Upon the unbroken skin it has no effect.

Josué and others have shown that repeated intravenous injections of adrenalin in rabbits sometimes lead to degenerative changes in the aorta and larger arteries, resembling atheroma. Whether these changes are the result of a direct toxic action, increase of blood-pressure, or constriction of the vaso vasorum, has not been definitely determined.

Upon plain muscle other than that of the vessels the action of adrenalin is not uniform. Thus, while it contracts the ureter, vas deferens, and seminal vesicles, and in the female, the uterus and vagina, it inhibits the movements of the stomach, bowel, and bladder. In the eye, the drug produces the effect of sympathetic excitation; namely, dilatation of the pupil, separation of the eyelids, and exophthalmos. It also promotes the secretion of certain glands, probably by stimulating the nerve-endings in their cells. Thus, it increases the tears, saliva, bronchial mucus, and bile. Injected intraven-

ously or intraperitoneally, and particularly wl directly to the surface of the pancreas, adrenal temporary glycosuria. This is apparently the re obscure toxic action exerted directly on the c pancreas.

**Therapeutics.**—As the characteristic effects on the general circulation occur only with its administration, and even then are extremely fugiti that its field of usefulness as a circulatory stimula very limited one. It appears to be chiefly indicate vasodilation with good heart muscle. Thus, in *s lapse during anesthesia*, it may prove life-savin conditions 10 minims (0.6 c.c.) of the solution (1 be given intravenously, drop by drop; or better, shock, intravenous transfusion may be practise part of the drug to 50,000 parts of normal salt so

As a local vasoconstrictor adrenalin is of gr *relieving congestion* and in *checking hemorrhage.* I on the eye, nose, and throat, solutions of 1 : 500 not only prevent bleeding, but render anesthesia more complete, and at the same time lessen the absorption of the anesthetic. In severe *epistaxis* p is usually afforded by plugging the nostrils with c in a 1 : 1000 solution. In *hematemesis* benefit ma from the administration of 10 to 30 minims (0.6– 1 : 1000 solution in a tablespoonful of water ev half-hour. In distant hemorrhages, however, adr less. Solutions 1 : 10,000 to 1 : 5000 are sometim in *acute coryza* and *hay fever.* Suppositories cont of adrenalin to 1000 of cocoa butter are reco *bleeding hemorrhoids.* The drug is said to relieve *ous inflammatory diseases of the eye*, but Lemare u its use when there is a tendency to iritis, conte may prove harmful by driving the blood from th the deeper anastomosing vessels of the iris and ci

Desiccated suprarenal glands (Glandulæ Suprar U. S. P.), in doses of 3–5 grains (0.2–0.3 gm.), have been shown to be of some value in *Addison'* most cases, however, the good effects have been rary, and this is what we should have expected, incurable nature of the local lesions. One of Os gained nineteen pounds, the asthenia disappeared, alive two years subsequently, but was still pigmen cutt has collected 48 cases treated with the extrac 6 were reported cured and 22 as improved. In e

value of these and similar statistics, due allowance should be made for the fact that favorable results are more likely to be published than those which are unfavorable.

## AMYLIS NITRIS, U. S. P.

(Amyl Nitrite, $C_5H_{11}NO_2$.)

Amyl nitrite is prepared by distilling equal volumes of pure amylic alcohol and nitric acid. It appears as a yellowish, highly volatile liquid having a strong ethereal odor.

**Physiologic Action.**—The inhalation of nitrite of amyl is speedily followed by flushing of the face, a sense of fulness in the head, quickening of the pulse, and a pronounced fall of blood-pressure. The flushing of the face and fall of blood-pressure are due to dilatation of the arterioles, which in turn is the result of the direct depressant action of the drug upon the vessel walls. The vasodilation is especially marked in the brain, abdominal organs, and "blush area" of the skin. The quickening of the pulse appears to be chiefly brought about by direct depression of the vagus center in the medulla oblongata, though it may be in part the result of the lowered blood-pressure, which tends to diminish the tonus in the medulla. Small doses do not affect the heart directly, but large doses depress it, exactly as they depress other forms of involuntary muscle. It is evident, therefore, that it is only by lessening resistance in the peripheral vessels that the nitrites can favorably influence the heart.

**Blood.**—When mixed with a nitrite blood acquires a chocolate color, owing to the transformation of oxyhemoglobin into methemoglobin. This compound is more stable than oxyhemoglobin, and cannot act as an oxygen carrier. In man the amount produced by medicinal doses, however, is so small that no harmful effects are seen. The blood-cells themselves are not injured, as with many other methemoglobin formers (coal-tar derivatives, potassium chlorate, pyrogallol), and in a short time the methemoglobin is reduced by the tissues and replaced by oxyhemoglobin. When present in the blood in large quantities methemoglobin gives rise to cyanosis and intense dyspnea.

**Respiratory System.**—Moderate doses slightly increase the rate and depth of the respirations, probably by acting directly on the respiratory center. Very large doses decrease the frequency and depth of the respirations by depressing the center.

**Nervous System.**—In man the nitrites have no direct action on the central nervous system. In frogs, however,

they depress the spinal cord and lessen reflex
The ringing in the ears, throbbing, and headache
the inhalation of amyl nitrite are the result of c
gestion. Convulsions are sometimes observed i
but they are probably due to asphyxia.

**Muscles.**—Other forms of plain muscle, as
ureters, bronchioles, and intestines, are also rel
nitrites, though not to the same extent as that c
vessels. Striated muscle is only slightly effected.

**Temperature.**—Some fall in temperature occu
erate doses, as a result of the dilatation of the cu
sels and increased radiation

**Elimination.**—Amyl nitrite undergoes oxida
body part being completely broken up and pa
creted in the urine as metallic nitrates and nitrites

**Therapeutics.**—Nitrite of amyl is employe
two purposes: To relax spasm and to lower art
Owing to the rapidity with which it is absorbed an
it is of service only when a very prompt but tra
is required.

**As an Antispasmodic.**—Inhalations of amyl
prove servicable in arresting the convulsions of *e*
*nus*, *uremia*, and *strychnin-poisoning*, though the m
drug's action is not apparent. When the seizures
are preceded by an aura the patient may carry the
small bottle containing the exact dose, or in gla
made especially for the purpose. Amyl nitrite son
good also in *asthma* and *whooping-cough*.

**As a Vasodilator.**—On account of the fugacio
action amyl nitrite is not so useful as nitroglycerir
tetranitrate in circulatory diseases associated wit
high arterial tension. In attacks of *angina pectoris*
often acts most happily. Curiously enough, the dr
likely to do good in this disease when the pulse is so
is hard. Brunton explains this fact in the followin
excessive work to be done, which is the cause of th
be due either to the resistance in the vessels bein
above the normal, or to the power of the heart t
the resistance being lessened below the normal.
case the resistance becomes too great for the h

The vasodilator action of the drug has led t
*malaria*, to cut short the first stage of the parox
said to be of service in *migraine*, when the pain i
with constriction of the peripheral vessels. By l
general arterial pressure, it may also have a salut
*hemoptysis*.

**Administration.**—Amyl nitrite is almost always given by inhalation: 2–5 min. (0.1–0.3 c.c.) may be dropped upon a handkerchief, or one of the small glass capsules containing the requisite dose may be crushed in a handkerchief, and the vapor inhaled. According to Osler it sometimes acts better in angina pectoris when given by the mouth, combined with the tincture of capsicum and peppermint-water. As a rule, however, nitroglycerin is better suited for internal administration.

### GLYCERYLIS NITRAS.

(Nitroglycerin, Glonoin, Glyceryl Trinitrate, Trinitrin, $C_3H_5(NO_3)_3$.)

Nitroglycerin is prepared by gradually adding dehydrated glycerin to nitric acid, or a mixture of nitric and sulphuric acids. It is official in the form of a 1 per cent. (by weight) alcoholic solution (*Spiritus Glycerylis Nitratis*, U. S. P.), the dose of which is from 1–3 min. (0.06–0.2 c.c.), cautiously increased until effects are manifested. The spirit should be kept in well-stoppered tin cans, and should be stored in a cool place, remote from lights or fire. Care must be exercised in handling it, since a dangerous explosion may occur if any considerable quantity be spilled.

**Physiologic Action.**—The action of nitroglycerin is similar to that of amyl nitrite, except that it is not quite so prompt, and is more persistent. Its effects are recognizable within a few minutes, and last, according to the dose, from one to two hours.

**Therapeutics.**—In *fatty and fibroid degeneration of the myocardium* nitroglycerin is often a useful remedy, especially when there is precordial pain or oppression. In *angina pectoris* it is often of value when given between the paroxysms, alone or in conjunction with potassium iodid. In *chronic valvular disease* it is sometimes advantageous to give nitroglycerin along with digitalis in order to counteract the tendency of the latter to constrict the peripheral vessels. In such cases, however, the two drugs should not be combined, since the action of the one is very prompt, but fugacious, while that of the other is slow, but persistent. No remedy equals nitroglycerin in relieving the high arterial tension, dyspnea, palpitation, headache, vertigo, and insomnia of *chronic nephritis*. On the other hand, in acute heart failure the drug may do harm by lowering still further the pressure in the coronary arteries, and in shock it is, of course, absolutely contraindicated.

In small, frequently repeated doses nitroglycerin sometimes proves effective in controlling persistent *hiccough*. Wade recommends it in the *abdominal palpitations* frequently seen in

nervous women. He believes that it acts by loweri
pressure in the splanchnic area. Good results
follow its use in *migraine* and *sciatica*. Tempo
sometimes obtained from its use in the asphyx
*Raynaud's disease*. It has also been highly reco
*hemoptysis*.

**Untoward Effects.**—In certain individuals t
dose of nitroglycerin induces flushing of the fac
tinnitus aurium, and vertigo.

**Administration.**—It may be given by the mo
cutaneously. For internal use, the available prep
the official spirit and the tablets, which are comn
in the market, and which contain from $\frac{1}{800}$–$\frac{1}{50}$ g
0.0012 gm.). For subcutaneous injection either t
soluble hypodermic tablets may be employed. It
portant that the preparation should be fresh, as bo
and tablets deteriorate with age. On account of
variation in individual susceptibility to the drug,
doses should be administered at first, and these g
creased until the therapeutic or physiologic effec
etc.) is secured. According to Wood, a single drop
insensibility; on the other hand, Whittaker has giv
as $8\frac{4}{5}$ gr. (0.56 gm.) in twenty-four hours withou
effects. Toleration of the drug is rapidly acquired
another reason for making the initial doses the s
will prove effective.

### ERYTHROL TETRANITRATE.

(Tetranitrol, $(CH_2.ONO_2)_2(CH.ONO_2)_2$.)

Erythrol tetranitrate occurs in the form of la
which are soluble in alcohol, insoluble in water,
readily explode on percussion. In the form of cl
cocoa-butter tablets, however, it may be handled w
safety. The dose is from $\frac{1}{2}$–2 gr. (0.03–0.13 gm.).

**Physiologic Action and Therapeutics.**—
of erythrol tetranitrate closely resembles that of nit
but it is milder and decidedly more prolonged.
case of the nitrites, patients vary considerably in
ceptibility to the drug: $\frac{1}{2}$ gr. (0.03 gm.) has cau
headache and great malaise lasting thirty-six hou
other hand, so much as $\frac{1}{2}$ dr. (2.0 gm.) in twenty-
has been given with good results.

Erythrol tetranitrate is indicated in the same cla
as nitroglycerin. On account of its prolonged
especially useful in *arteriosclerosis*, *angina pecto*
*interstitial nephritis*, and *Raynaud's disease*.

### SODII NITRIS, U. S. P.

(Sodium Nitrite, $NaNO_2$.)

Sodium nitrite occurs in the form of white, opaque, fused masses, or colorless, transparent crystals, odorless, and of a mild saline taste. It is soluble in 1.4 parts of water, and sparingly soluble in alcohol. The dose is from 2–3 gr. (0.13–0.2 gm.).

**Therapeutics.**—The action of sodium nitrite is identical with that of amyl nitrite, except that it is less rapid and more lasting. As a vasodilator it is not so reliable as erythrol tetranitrate, although it resembles that drug in the permanency of its effects. It is indicated in the same class of cases as erythrol tetranitrate and nitroglycerin.

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## RESPIRATORY STIMULANTS.

The following drugs stimulate the respiratory center in the medulla oblongata:

| | |
|---|---|
| Ammonia. | Cocain. |
| Strychnin. | Atropin. |
| Caffein. | Aspidospermin. |

In addition to these drugs, *external heat* increases the depth of the respirations. The expiratory and inspiratory fibers of the vagus are stimulated by the rhythmic expansion and collapse of the lung, which takes place in the practice of artificial respiration by *Sylvester's method.* In pursuing this method the patient is placed in a supine position; his arms are drawn upward and outward so as to fully expand the chest; after a pause of a few seconds the arms are brought down forcibly to the sides of the chest and pressed against them for a second. These movements are repeated about sixteen or eighteen times in a minute. The respiratory center may be stimulated also reflexly by irritating certain peripheral sensory nerves. Thus, in *Laborde's method* of treating asphyxia by rhythmic traction of the tongue, the center is affected through the sensory nerves of the tongue. This method consists in drawing the tongue outward and upward by means of forceps for from twelve to fourteen times a minute.

The *vapor of ammonia* when inhaled stimulates the nasal branches of the fifth nerve, and thus reflexly excites the respiratory center. The use of the cold douche, the pouring

of ether on the bare chest, and the application c current to the skin are also means of arousing th center through peripheral irritation.

Drugs which stimulate the respiratory center in pulmonary affections associated with marked d as *pneumonia*, *severe bronchitis*, and *emphysema*; soning by drugs which cause asphyxia, such a *ether*.

The various measures by which the respirat stimulated reflexly are especially indicated in poi

## RESPIRATORY DEPRESSAN

The following drugs depress the respiratory ce

| | |
|---|---|
| Opium (morphin, codein). | Bromi |
| Chloral. | Hyosc |

In addition to these drugs there are many ot veratrum, gelsemium, physostigma, belladonna, acid, alcohol, ether, phenol, salicylic acid) that ca in *toxic doses*.

Certain of the respiratory depressants, notabl its alkaloids and the bromids, are employed i diseases to *allay cough*.

## CEREBRAL EXCITANTS.

Our knowledge concerning the action of drugs is very imperfect. We know, however, that ce stimulate the motor area, and in large doses caus in movement and even epileptiform convulsions, affect chiefly the psychic centers and increase the intellectual work. To the first class belong:

| | | |
|---|---|---|
| Atropin. | Cocain. | C |

*Heavy metals* (lead, copper, silver) and certai especially camphor, oil of wormwood (absinth), oil oil of nutmeg, in toxic doses also cause epilepti by exciting the cerebral cortex.

*Cornutin* (see Ergot) and *picrotoxin* in large

convulsions, which are apparently due to intense excitation of the medulla oblongata, since they cease after removal of the latter, but persist after removal of the cerebrum.

The chief representative of the second class of cerebral stimulants, or of those which act on the psychic centers of the brain is *caffein*. Cocain also stimulates the higher functions, but much less powerfully those of the lower centers, such as the motor.

A number of drugs (alcohol, ether, atropin) cause more or less mental excitement, but at no time exert any real stimulant effect on the highest intellectual functions—attention, perception, judgment. The excitement is probably due to depression of the inhibitory or controlling centers of the brain. In large doses these drugs cause confusion of thought and delirium.

A few of the cerebral excitants, particularly atropin, caffein, and cocain, are useful in arousing the cerebral centers when they have been profoundly depressed by poisons, such as opium.

## BELLADONNA.

(Deadly Nightshade.)

Belladonna is official as the leaves (*belladonna folia*) and as the root (*belladonna radix*) of *Atropa Belladonna*, a bushy perennial, a native of Europe, but largely cultivated in North America. The chief active constituents are the two alkaloids *atropin* and *hyoscyamin*, though a third alkaloid, *hyoscin*, is also present in minute quantities. Hyoscyamin is isomeric with atropin and is readily changed to it. Indeed, the preparations of belladonna apparently owe their activity very largely to atropin, which is official as *Atropina* and *Atropinæ sulphas*. Both the alkaloids and its salts appear in the form of a white crystalline powder, having an acrid, bitter taste. The former is sparingly soluble in water, the latter in 0.4 part of water and 3.7 parts of alcohol. The dose of atropin is $\frac{1}{120}$–$\frac{1}{75}$ gr. (0.00032–0.00086 gm.); of atropin sulphate, $\frac{1}{150}$–$\frac{1}{60}$ gr. (0.00043–0.0013 gm.).

| Preparations. | Dose. |
|---|---|
| Tinctura Belladonnæ Foliorum, U. S. P. . . | 5–20 min. (0.3–1.2 c.c.). |
| Extractum Belladonnæ Foliorum, U. S. P. . . | $\frac{1}{4}$–$\frac{1}{2}$ gr. (0.008–0.016 gm.). |
| Fluidextractum Belladonnæ Radicis, U. S. P., | 1–3 min. (0.06–0.2 c.c.). |
| Emplastrum Belladonnæ, U. S. P. | |
| Unguentum Belladonnæ, U. S. P. (10 per cent.). | |

**Physiologic Action.**—When taken internall
doses belladonna produces dryness of the throa
of the pupils, quickening of the pulse, elevation
ture, and sometimes talkative delirium and an er
rash. The rash generally appears on the face an
resembles that of scarlatina, but it lacks the cl
punctations of the latter.

**Circulatory System.**—In moderate doses atrop
the pulse, raises the arterial pressure, and increases
of the heart per unit of time. The acceleration of
due to depression of the peripheral fibers of the v
heart. Prior to the acceleration there is occasionally
ing from stimulation of the inhibitory center in the
this effect is always transient. Because of the low
vagal fibers in the extremes of life little or no ch
pulse-rate follows the use of the drug in infants and
The elevation of the blood-pressure is due in part
constriction of the splanchnic vessels from stimul
vasoconstrictor center in the medulla, and in part
tion of the heart-beat. While the abdominal vess
stricted, however, those of the skin are dilated fro
of the vasodilator center, hence the tendency to ar
tous rash in belladonna-poisoning. Large doses
ultimately lower the blood-pressure by depressin
muscle.

**Respiratory System.**—Moderate doses of the
late the respiratory center and render the respirati
and deeper. Large doses paralyze the respiratio
poisoning the breathing ceases before the heart-be

**Nervous System.**—The action of atropin on
nervous system is a complex one. In man, large
restlessness and excitement, then talkative delirium,
stupor and coma. The first of these effects is pro
stimulation of the brain, especially of the motor a
later ones to depression of the brain, first of the
centers and then of the psychic centers. In frogs
the poor development of the brain, the action of
chiefly on the spinal cord and motor nerves. Thu
doses, there is a loss of reflex excitability with cess
untary movements lasting a day or two, then re
exaggerated reflexes and clonic convulsions. The p
is apparently due to paralysis of the motor nerve-
the secondary effect to stimulation of the spinal co

Under atropin the peripheral endings of the n
unstriped muscle of the bronchioles, stomach, intest

and bladder are all depressed. The motor nerve-endings in the voluntary muscles are depressed in frogs, but not perceptibly in man. The terminations of the sensory nerves are depressed by local applications of the drug, but not when it is given internally.

**Secretory Glands.**—By depressing the nerve-endings in the secretory glands, atropin lessens nearly all the secretions—saliva, mucus, sweat, gastric juice, and milk. The pancreatic secretion and urine are not much affected, as the pancreas and kidneys are only partially controlled by the nerves.

**Alimentary Canal.**—Atropin diminishes the total quantity of gastric juice and also the percentage of hydrochloric acid. Large doses decrease intestinal peristalsis, while small doses apparently increase it. Given with purgatives it prevents griping, but the manner of its action is not known.

**Temperature.**—Large doses often cause a marked rise of temperature, probably by acting directly on the thermogenic centers.

**Eye.**—Atropin dilates the pupil by paralyzing the oculomotor nerve-endings in the sphincter muscle of the iris, and destroys the power of accommodation by paralyzing the nerve-endings in the ciliary muscle. Like other mydriatics, it also raises the intra-ocular pressure. These effects of the drug in the eye are best seen after its local application.

**Elimination.**—Atropin is excreted chiefly by the kidneys, though much of it undergoes oxidation in the tissues.

**Toxicology.**—The characteristic phenomena of belladonna-poisoning are dryness of the throat, dilated pupils, rapid pulse, hurried respiration, restlessness, talkative delirium, an erythematous rash, and, finally, stupor, paralysis, and collapse.

The urine of patients suffering from belladonna-poisoning when dropped into the eye of an animal (except birds) causes dilatation of the pupil.

**Treatment of Poisoning.**—After evacuating the stomach, tannic acid should be administered as a chemical antidote. Respiratory and circulatory stimulants are frequently required. Opium, physostigma, and jaborandi are somewhat antagonistic to belladonna, and, therefore, have been recommended as physiologic antidotes. Considerable caution should be exercised in their employment.

**Therapeutics.**—Belladonna is employed chiefly to relax spasm, to check excessive secretion, to stimulate the vasomotor center, to dilate the pupil, and paralyze accommodation, to allay peripheral irritation, to stimulate intestinal peristalsis, to impress the nervous mechanism of the heart, and to antagonize certain poisons.

**To Relax Spasm.**—It is of little value in gene
sions of cerebral or spinal origin, but it is of gr
in local spasms excited by peripheral irritation.
useful in *whooping-cough* and *laryngismus stridul*
various forms of *colic*—renal, biliary, and intestin
is a valuable adjuvant to morphin, and should
freely to guard the latter and to relax spasm. It
may be given internally, but inhalation of the sm
by burning the leaves often gives better results.
*continence of urine* is due to vesical hyperesthesia
of the sphincter, as it frequently is in children, be
a very reliable remedy. To be effective, however,
must be pushed to the point of intolerance, that
causes dryness of the throat and dilatation of the
obstinate *torticollis* or *wry-neck* intramuscular in
atropin are often followed promptly by relief. In
*the anal sphincter* and in *dysmenorrhea* suppositori
donna are often efficacious.

**To Check Excessive Secretion.**—Atropin is
best remedies we possess for controlling the *night*
phthisis. A dose of $\frac{1}{200}$–$\frac{1}{100}$ gr. (0.00032–0.000
bedtime is sufficient. Unfortunately, untoward ef
ness of the throat, thirst, and dimness of vision—oft
against its use. In *salivation* from mercury it is a
In *hyperidrosis* of the hands and feet belladonna is
as an internal remedy and as a local application.
mother is unable to suckle her child and the breas
swollen and tender, the thorough application of an
of belladonna will often serve to arrest the secreti
and to prevent suppuration, even though the la
imminent. In *leucorrhea* with ulceration of the os ut
seau's suppositories containing 1 gr. (0.06 gm.) of
and 8 gr. (0.5 gm.) of tannin will be found beneficia

In the *bronchopneumonia* of childhood belladonn
doses (2 drops of the tincture every hour) is of
utmost value in lessening secretion and in relievin
In *pneumonia* with edema it is also useful.

**To Stimulate the Vasomotor Center.**—In *shoc*
*lapse* atropin hypodermically is useful, though much le
than adrenalin intravenously. It has also been rec
as a vasomotor stimulant in the algid stage of *choler*

**To Dilate the Pupil and Paralyze Accommoda**
drop or two of a solution of atropin, having the str
gr. (0.26 gm.) to the ounce (30.0 c.c.), be dropped int
junctival sac, dilatation of the pupil begins in a few m

attains its maximum in about half an hour. Accommodation is not affected quite so quickly, paralysis not being complete within an hour and a half. On the other hand, mydriasis persists somewhat longer than the suspension of accommodation. The effect of a 4-grain solution usually lasts from ten days to two weeks.

Atropin may be employed as a mydriatic to *facilitate ophthalmoscopic examination*, but euphthalmin, cocain, or homatropin should be given the preference, since the action of these drugs is much less persistent. In estimating *errors of refraction* it is necessary to select a mydriatic that will suspend the accommodation, and for this purpose atropin may be used, although there are cycloplegics equally efficient and less persistent in their effects. In *iritis* it is indispensable in preventing and in breaking up adhesions between the iris and the capsule of the lens. In *acute keratitis* it is also very useful in allaying the ciliary irritation.

The sulphate, on account of its ready solubility, is the salt usually selected. As a simple mydriatic ¼ gr. (0.016 gm.) to the ounce (30.0 c.c.) is sufficient, and the mydriasis from this solution will not last more than four or five days. As a cycloplegic in refraction work a strength of 4 gr. (0.26 gm.) to the ounce (30.0 c.c.) should be employed. A like solution is generally used in iritis. In keratitis a solution containing 1–2 gr. (0.065–0.13 gm.) to the ounce (30.0 c.c.) will be effective.

**To Allay Peripheral Irritation.**—In the form of an ointment or plaster belladonna makes a very useful sedative application in *muscular rheumatism* (pleurodynia, wry-neck, lumbago), in *inflammatory affections of the joints*, *orchitis*, and *chronic heart-disease*.

Suppositories containing the extract are much used in *painful hemorrhoids*, and for the relief of *painful defecation* due to inflammation of the pelvic organs.

**To Stimulate Intestinal Peristalsis.**—Belladonna is a useful adjuvant to other drugs in *chronic constipation*. By allaying spasm of the intestinal muscles it also prevents griping.

**To Impress the Nervous Mechanism of the Heart.**—Although the manner of its action is obscure, belladonna is often efficacious in *nervous palpitation* and *tachycardia*. It may be applied over the region of the heart in the form of a large plaster, or given internally, alone or in combination with sodium bromid. In some cases of *exophthalmic goiter*, when given in doses large enough to cause some dryness of the throat, it is more useful than any other drug. For the purpose

of blocking inhibitory influences on the heart, Allb advises the use of atropin hypodermically at the l attacks of *angina pectoris*.

**To Antagonize Certain Poisons.**—It is a use in *poisoning by opium*, *physostigma*, *muscarin* (pois ciple of toadstools), *hydrocyanic acid*, *aconite*, *jac chloroform*.

**Administration.**—The root and leaves are no nally. The tincture is the most reliable of the liq tions. For subcutaneous administration the sulpha should be employed, since atropin is only sparing water. Children are relatively less susceptible to than adults, and, therefore, often tolerate much l than their age would naturally indicate. The fo mulæ will serve to illustrate the manner of pre drug:

℞ Atropinæ sulphatis, gr. j (0.065 gr
Acidi borici, gr. x (0.65 gm
Aquæ destillatæ, f℥j (30.0 c.c.)
Sig. A drop or two to be instilled into the conjunctivæ twice *keratitis*.)

℞ Tincturæ belladonnæ, f℥iss (5.5 c.c.)
Glycerini, f℥ij (7.4 c.c.)
Aquæ menthæ piperitæ, q. s. ad f℥ij (60.0 c.c.)
Sig. Thirty minims three times a day for a child of three years. gradually increased until slight flushing of the face is induced. (*W*

℞ Extracti belladonnæ, gr. x (0.65 gm
Acidi tannici, gr. vj (0.4 gm
Hydrargyri chloridi mitis, gr. xxx (2.0 g
Cocainæ gr. vj (0.4 gm
Unguenti petrolati, ℥j (31.0 gm.).
Sig. Apply night and morning after washing the parts. (*Her*

**Incompatibles.**—Atropin should not be p solutions containing caustic alkalies or tannic acid

## STRAMONIUM.

(Jamestown Weed; Thorn-apple.)

The drug is official as the leaves of *Datura S.* weed growing in waste places in Europe, Asia, and contains *atropin*, *hyoscyamin*, and a minute quanti

| Preparations. | Dos |
|---|---|
| Tinctura Stramonii, U. S. P. . . . . | 10–20 mi |
| Fluidextractum Stramonii, U. S. P. . . . . | 1–3 min. |
| Extractum Stramonii, U. S. P. . . . . | ¼–½ gr. (0 |
| Unguentum Stramonii, U. S. P., contains 10 per cent. of the | |

**Therapeutics.**—Stramonium is a therapeutic equivalent of belladonna, and may be employed in the same class of diseases in which the latter is prescribed. It has a special reputation in *asthma*, in which disease it may be used in the form of cigarettes made of the dried leaves. Ointment of stramonium with an equal amount of ointment of galls makes a useful application for *hemorrhoids*.

## HYOSCYAMUS, U. S. P.

(Henbane.)

The leaves and flowering tops of *Hyoscyamus niger*, a plant growing in Europe, Asia, and North America. They contain *hyoscyamin* and *hyoscin*, and a small quantity of *atropin*.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Hyoscyami, U. S. P. . . . . | 20–60 min. (1.2–3.7 c.c.). |
| Fluidextractum Hyoscyami, U. S. P. . . . | 5–20 min. (0.3–1.2 c.c.). |
| Extractum Hyoscyami, U. S. P. . . . . | ½–3 gr. (0.03–0.2 gm.). |

**Physiologic Action.**—In full doses hyoscyamus acts like belladonna, causing dilatation of the pupils, dryness of the throat, and quickening of the pulse and respiration. On the brain its action is somewhat more sedative than that of belladonna.

**Therapeutics.**—Like belladonna, it is used to relax *spasm* and to allay *peripheral irritation*. It may be employed in *whooping-cough*, in *bronchitis* with harassing cough, when opium is contraindicated, and in *incontinence of urine* due to vesical irritation. It is also a useful vesical sedative in *acute cystitis*.

## SCOPOLA, U. S. P.

Scopola is the dried rhizome of *Scopola carniolica*, a perennial plant growing in southern Europe. It is closely related to belladonna and hyoscyamus. It contains several alkaloids, the chief of which are *hyoscyamin* and *scopolamin*. Scopolamin appears to be identical with hyoscin, and is official in the form of the hydrobromid (*Scopolaminæ hydrobromidum*).

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Scopolæ, U. S. P. . . . . | 1–3 min. (0.06–0.2 c.c.). |
| Extractum Scopolæ, U. S. P. . . . . | ¼–½ gr. (0.008–0.016 gm.). |

**Physiologic Action and Therapeutics.**—Scopola closely resembles hyoscyamus in its action, and may be used for the same purposes.

Injections of scopolamin and morphin have been used to

some extent as a means of inducing *general anesth* an ardent advocate of the method, makes three the first 2½ hours, the second 1½ hours, and the t before the operation, using in all $\frac{1}{60}$ gr. (0.001 g polamin and $\frac{1}{3}$ gr. (0.02 gm.) of morphin. The ad the method are said to be the absence of mental bronchial irritation, and vomiting. As scopolami phin, however, are not, as was formerly supposed, in their action on respiration, considerable caution exercised in using them thus conjointly in such la

### HYOSCYAMINA.

Hyoscyamin is official in the form of the sul *cyaminæ sulphas*) and the hydrobromid (*Hyoscya bromidum*), both of which are freely soluble in dose of either salt is from $\frac{1}{150}$–$\frac{1}{75}$ gr. (0.0004–0 Hyoscyamin has an action almost identical in ki of atropin, though it depresses more powerfully th the nerve-endings in the secretory glands, eye, et ful *facial spasm* and *torticollis* it is sometimes Dana has recommended it in the *chorea of childh* afford relief in the tremors of *paralysis agitans*, *sclerosis*, and chronic *mercurial poisoning*.

### HYOSCINA.

Hyoscin itself is a colorless syrupy liquid, but solid and crystalline. Of the latter the hydrobr *cinæ hydrobromidum*) is official, and may be given $\frac{1}{150}$–$\frac{1}{75}$ gr. (0.0004–0.0008 gm.). Hyoscin depre minations of the same nerves as atropin. Its a respect, however, is more prompt and powerful atropin, and its effect less persistent. Unlike atropin the cerebrum almost from the beginning, a dos (0.0005 gm.) usually being sufficient to induce s causing a preliminary stage of excitement. It also atropin in not stimulating, but rather depressing, th and vasomotor centers in the medulla. In large d tendency to produce paresis of the throat muscles, reason is contraindicated in affections involving th diphtheria and scarlet fever. Toxic doses induce the throat, dilatation of the pupils, stupor, coma, e ing of the respirations and pulse, and muscular rel animals death results from asphyxia.

On account of the very pronounced susceptibili persons to the action of hyoscin, the initial dose sh be small.

**Therapeutics.**—Hyoscin hydrobromid is used as a somnifacient, a depressomotor, and an anaphrodisiac. It is a very efficient somnifacient in *insomnia*, associated with great mental or emotional excitement; thus it often acts admirably in *mania*, *delirium tremens*, *melancholia agitata*, and *typhoid fever* with active delirium. As it has little effect upon the circulation, it sometimes acts favorably as a somnifacient in *chronic heart disease*, but usually it is inferior to morphin. Given hypodermically in doses of $\frac{1}{200}$ gr. (0.0003 gm.) twice daily, gradually increased, it is sometimes useful in quieting the violent movements of *acute chorea*. It is the best remedy that we have in diminishing the severity of the tremors and in allaying the restlessnes of *paralysis agitans*. A dose of $\frac{1}{100}$ gr. (0.0004 gm.), gradually increased to $\frac{1}{80}$ gr. (0.0008 gm.), may be given in chloroform-water two or three times a day. It is an excellent remedy in *spermatorrhea*, *erotomania*, and allied sexual disorders.

**Administration.**—It may be given hypodermically, or by the mouth in pills, granules, or aqueous solution.

## COCA, U. S. P.

The leaves of *Erythroxylon Coca*, a native of Peru and other South American States. It contains several alkaloids, the most important being *cocain*, which is official as *Cocaina*, and *Cocainæ hydrochloridum*. Both the free alkaloid and the salt appear in the form of colorless prismatic crystals, having a slightly bitter taste, and producing on the tongue a temporary numbness. Cocain is sparingly soluble in water (1 : 600 parts), much more so in alcohol (1 : 5), in ether (1 : 3.8), and olive oil (1 : 12); cocain hydrochlorid is freely soluble in water (1 : 0.4 parts), somewhat less so in alcohol (1 : 2.6), and insoluble in ether and oils. The dose of either cocain or its salt is from $\frac{1}{4}$–1 gr. (0.015–0.06 gm.). Cocain to the amount of 5 per cent. is contained in the newly introduced oleate of coca (*Oleatum cocainæ*).

| Preparations. | Dose. |
|---|---|
| Fluidextractum Cocæ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Vinum Cocæ, U. S. P. . . . . | 2–8 fl. dr. (8.0–30.0 c.c.). |

**Physiologic Action.**—In full doses cocain raises the arterial pressure and increases the rate of the pulse. The rise of arterial pressure is due to stimulation of the vasomotor center and acceleration of the heart, and, perhaps, also, to constriction of the vessels from a peripheral action. The increased

pulse-rate is probably due to stimulation of the accelerator mechanism and depression of the vagal endings. After very large doses there is a pronounced fall of the arterial pressure from paralysis of the heart and vasomotor center.

Locally, it is a powerful vasoconstrictor; the ischemia, however, is finally replaced by congestion.

**Central Nervous System.**—Cocain first stimulates and then depresses the central nervous system—brain, medulla, and spinal cord. Both the psychic and motor areas of the brain are affected, large doses first inducing wakefulness, mental exhilaration, physical unrest, and then more or less depression. Toxic doses not rarely cause clonic convulsions of cerebral origin. The injection of a small quantity into the spinal canal is followed in a few minutes by complete anesthesia of the entire lower half of the body, without any disturbance of consciousness.

**Respiratory System.**—In small doses it increases both the depth and the rate of the respirations by stimulating the respiratory center. Toxic doses render the respiratory movements irregular in rhythm and shallow, and finally kill through asphyxia.

**Muscles.**—It appears first to stimulate and then to paralyze striated muscles.

**Kidneys.**—Cocain has very little influence on the excretion of urine. The nitrogenous elimination is probably slightly decreased.

**Alimentary Canal.**—Small doses increase and large doses diminish peristaltic movement.

**Temperature.**—Therapeutic doses are without effect, but toxic doses cause a rise of temperature, probably by increasing heat production.

**Local Action.**—A very important physiologic property of cocain is its power, when applied directly to a mucous membrane or an abraded surface, or when injected under the skin, of inducing temporary anesthesia of the part by paralyzing the sensory nerve-filaments. The anesthesia begins in from five to ten minutes, and generally lasts from twenty to thirty minutes. The application of cocain solutions directly to cutaneous surfaces is without effect, since absorption through the epidermis is very slight. In addition to anesthesia, cocain causes a blanching of the part, which is subsequently followed by congestion. Applied in sufficient concentration, it is a general protoplasmic poison, nerve-tissue being especially sensitive to its influence.

**Eye.**—The instillation into the eye of a few drops of a 4

per cent. solution of cocain hydrochlorid causes in from ten to fifteen minutes, in addition to anesthesia, contraction of the conjunctival vessels and moderate dilatation of the pupil. The mydriasis attains its maximum in about an hour, and persists for from twelve to fifteen hours. It is of peripheral origin, and is probably caused by stimulation of the sympathetic nerve-endings. Cocain has but little effect on accommodation. Strong solutions have an injurious effect upon the corneal epithelium.

**Toxicology.**—The symptoms of *acute cocain-poisoning* are somewhat variable; the usual phenomena, however, are nervous excitement, followed by delirium, and ultimately by stupor; nausea, vomiting, a very rapid pulse, hurried respirations, elevation of temperature, dilatation of the pupils, and convulsive seizures.

The **treatment** is purely symptomatic. When there are symptoms of circulatory and respiratory failure, ammonia, atropin, and strychnin are indicated. When cerebral excitement and convulsions are prominent features, inhalations of chloroform may be employed, and bromids and chloral may be administered tentatively.

**Untoward Effects of Medicinal Doses.**—There is a very wide variation in individual susceptibility to cocain. In some subjects the local application of the drug to the nose or throat, even in solutions of moderate strength, is followed by nausea, vomiting, blindness, syncope, or convulsions.

**Chronic Poisoning** (*Cocainism*).—A potent cause of the cocain-habit has been the frequent use of the drug in diseases of the nose and throat. Tyson states that he has known three successive chiefs of clinic in nose and throat dispensary service to acquire the habit. The habit is also common among those addicted to other narcotics, such as opium, alcohol, and chloral. The chief symptoms are emotional excitement, physical unrest, mental impairment, moral turpitude, hallucinations, mild epileptiform attacks, dilatation of the pupils, a rapid, feeble pulse, severe gastric disturbance, wasting, and anemia. When cocainism is uncomplicated the prognosis is guardedly favorable. The drug should be withdrawn rapidly but not suddenly. Treatment in a sanatorium is always advisable. Stimulants like strychnin are often useful. Hygienic and dietetic measures calculated to improve general nutrition are indicated.

**Therapeutics.**—Cocain is employed as a local anesthetic, mydriatic, and respiratory and circulatory stimulant.

**As a Local Anesthetic.**—As a local anesthetic cocain has a

very wide range of usefulness. In the various op
the eye, nose, throat, urethra, and rectum it is in
In minor surgical operations—like amputation of
removal of small neoplasms, opening of small al
may also be employed with advantage. In these
must be taken to prevent undue absorption of th
this is best accomplished by the application of a t
band to the proximal side of the part to be operat
controlling the circulation. A 2 per cent. soluti
injected to the extent of a dram with safety. Tl
oozing should not be checked immediately, as it ser
off the cocain. The same quantity of cocain in we
is distinctly less toxic than it is when in strong soluti

In operations in which the circulation cannot be
and in which much of the solution must be allowe
in the tissues, the method employed by Schleich
*infiltration anesthesia*, is of very great value. Schlei
solutions of three strengths. The one of medium st
sisting of—

| | |
|---|---|
| Cocain hydrochlorid, | 1 gr. (0.065 gm |
| Morphin hydrochlorid, | $\frac{1}{8}$ gr. (0.013 gm |
| Sodium chlorid, | 2 gr. (0.13 gm.) |
| Sterilized distilled water, | 2 fl. oz. (60.0 c.c |

The stronger solution contains 2 gr. (0.13 gm.
and the weaker solution, $\frac{1}{10}$ gr. (0.0065 gm.).

The important factors in the induction of anesth
method are the ischemia of the tissues caused by t
of the injected fluid, the compression of the tern
filaments from the same cause, and the direct para
sensory nerves by the cocain. The effect of the
not local, but general. Physiologic salt-solution i
as the vehicle, because it is unirritating to the tissu

The field of operation may be infiltrated *en mass*
be surrounded by an anesthetic edematous zone.
the nerves leading to the part may also be cocai
some distance from the prospective incision, or dire
are exposed in the wound.

An ordinary antitoxin syringe capable of holdi
10 c.c. may be employed. The derm should b
before the deeper tissues are injected. The needle
introduced obliquely, a few drops of the solution
out; the needle is then thrust deeper and deeper,
of the fluid is injected in various directions until
thoroughly edematized. The subsequent applic
ice-bag to the part will intensify the analgesic

injection. At least five minutes should elapse after the infiltration before the incision is made. The period of analgesia generally lasts from twenty to thirty minutes. The strength of the solution and the amount employed will depend upon the sensitiveness of the part, the extent of the operation, and the amount of cocain that is likely to be retained in the tissues. It is not safe to allow more than 1 grain of cocain to remain in the part. Of the strong solution, 1 ounce (30.0 c.c.); of the solution of medium strength, 2 ounces (60.0 c.c.); and of the weak solution, 10 ounces (300.0 c.c.) or more may be employed without risk.

*Medullary Cocainization.*—The employment of spinal subarachnoid injections for the purpose of inducing analgesia was suggested by Corning in 1885, and made practical by the researches of Bier, published in 1899. The technic of medullary cocainization is as follows: The entire lumbar and sacral region is prepared with antiseptic care as for operation; the patient is placed in a sitting posture, and the injection is made at the level of the crest of the ilium, that is, just above or below the fourth lumbar vertebra, and 1 cm. ($\frac{1}{3}$ in.) external to its spinous process. The solution is injected through a fine iridoplatinum needle, about 9 cm. (3–4 in.) long, attached to an ordinary hypodermic syringe capable of holding 2 c.c. (30 min.). As the injection should not be made before a flow of cerebrospinal fluid is observed, the needle should be introduced into the subarachnoid space before the syringe is attached. The injection is made very slowly, and to insure the retention of the solution the needle is held *in situ* for about a minute, then carefully withdrawn, and the puncture sealed with collodion. A 2 per cent. solution (9 gr.–1 oz.—0.6 gm.–30.0 c.c.) of cocain hydrochlorid is usually employed; it should be freshly prepared and sterile. From 15–20 min. (1.0–1.2 cc.) are injected. The amount of cocain should not exceed $\frac{2}{3}$ gr. (0.025 gm.). Analgesia extending downward from about the level of the diaphragm follows in from five to ten minutes, and usually persists about an hour and a half.

The relative value of this method of inducing analgesia has not yet been determined; it is certainly not altogether free from danger. Unpleasant after-effects—fever, headache, vertigo, nausea, and vomiting—are of frequent occurrence. Cocain analgesia is not suitable for prolonged, complicated operations, especially when they are intra-abdominal; and since it does not induce unconsciousness, it should not be employed in young children nor in insane or hysteric adults.

In *inflammations* and *ulcerations of the nose, pharynx,* and *larynx* cocain may be employed alone or in combination with antiseptic sprays or powders. In *acute coryza* and *hay-fever* it gives great relief by lessening the sensibility and constricting the turgid tissues.

In *laryngeal tuberculosis* it is invaluable for the relief of the intense pain and dysphagia. It may be given in insufflation in combination with iodoform, iodol, or morphin. As a local anesthetic it is also used internally to relieve the pain of *gastric ulcer* and to check *excessive vomiting.*

The application of a 10 per cent. solution of cocain hydrochlorid on a cotton pledget has been found useful in *rigidity of the os uteri.*

**As a Mydriatic.**—As a mydriatic, *cocain* is not so generally useful as atropin. Since, however, it only slightly impairs accommodation, and its effects pass off in a few hours, it is a convenient mydriatic for *retinal examinations.* In iritis atropin is distinctly preferable on account of its forcible action and lasting effect. The mydriatic effect of cocain is readily neutralized by the instillation into the eye of a few drops of a ½ per cent. solution of eserin.

**As a Respiratory Stimulant.**—Cocain is an active respiratory stimulant, and for this reason, and also on account of its general excitant influence, it is a useful physiologic antidote in *opium-poisoning.*

**As a Circulatory Stimulant.**—In *adynamic pneumonia,* cocain, administered hypodermically, is an efficient adjuvant to strychnin.

**Administration.**—As a local anesthetic to mucous membranes the hydrochlorid is employed in solutions varying in strength from 2 to 20 per cent. The mucous membrane of the larynx is less susceptible than that of the nose or throat. On the latter, from 4 to 6 per cent. solutions are usually sufficient. A solution stronger than 4 per cent. should not be used in the eye on account of the danger of inducing degenerative changes in the corneal epithelium.

Aqueous solutions of cocain lose in efficacy on boiling, methyl alcohol and benzoic acid being split off from the alkaloid.

The drug is not well borne by children and women of a neurotic temperament. The danger of causing the habit from the frequent use of cocain in chronic diseases of the nose and throat must never be lost sight of, and under no circumstances should the remedy be placed in the patient's own hands. In tuberculous laryngitis with dysphagia small

tablets containing from $\frac{1}{20}$—$\frac{1}{12}$ gr. (0.003–0.005 gm.) of cocain may be allowed to dissolve slowly in the mouth, or the drug may be used in the form of a powder or spray:

℞ Cocainæ hydrochloridi, gr. xx (1.3 gm.);
Resorcinol, gr. x (0.65 gm.);
Aquæ, ℥j (30.0 c.c.)—M.
Sig. To be used as a spray. (*Tuberculous laryngitis.*)

The fluidextract and the wine of coca are used as mild stimulants.

**Incompatibles.**—Cocain is incompatible with tannic acid, alkaline carbonates, iodids, borax, and zinc sulphate. It cannot be added to Dobell's solution, since the latter contains borax.

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## CEREBRAL DEPRESSANTS.

The cerebral depressants may be classed as somnifacients, general anesthetics, general analgesics, and anticonvulsants.

*Somnifacients* or *hypnotics* are remedies which induce sleep. The factors favoring natural sleep are the withdrawal of afferent stimuli, decreased responsiveness of the brain-cells as the result of fatigue, the accumulation in the blood of products evolved by the cells in the exercise of their functions, and, finally, lessening of the blood-supply to the brain. Pure somnifacients inhibit the functional activity of the brain-cells, but they do not completely suspend the power of the cells to recuperate (the main object of sleep) nor to react to stimuli which reach them from without.

*General anesthetics* are drugs which induce unconsciousness and insensibility. Their effect upon the brain-cells is much more profound than that of the hypnotics, in that they temporarily inhibit the responsiveness of the cells to external stimuli, and suspend more or less completely recuperative changes.

*General analgesics* or *anodynes* are remedies which relieve pain. They may act either by directly influencing the receptive centers in the brain or by preventing the transmission of painful impressions through the sensory nerves and spinal cord to the brain.

*Anticonvulsants* are remedies which check excessive motor activity. In the case of cerebral convulsions they may act by directly depressing the cells in the cortex of the brain, by

lessening the power of the sensory tract in th nerves and spinal cord to transmit to the brain from without, or by lessening the power of the n the spinal cord and peripheral nerves to transmit cles the excessive discharges emanating from th

## SOMNIFACIENTS.

The most important element in the treatment is the removal of the cause. A potent factor in n persistent insomnia is the circulation in the blood ucts of faulty metabolism, as seen in dyspepti subjects. In such affections a careful regulation of the utmost importance. The evening meal espe be simple and light. Systematic exercise, coup use of mild mercurial or saline aperients, often effective in promoting sleep than the exhibition In the aged insomnia is very often associated with cular tone, and when such is the case, small doses are beneficial. In chronic valvular disease sti digitalis, strophanthus, and nux vomica are i chronic Bright's disease insomnia is a common s it may depend upon the retention in the blood o tious materials or it may be due to high arterial the former case a milk-diet and the use of elimi most helpful, and in the latter case the administra vasodilator, such as nitroglycerin or erythrol tet often afford marked relief. Tea, coffee, and toba times preventives of sleep, and if so they must be u or perhaps altogether avoided. When anemia is a iron and arsenic will be needed. Insomnia fro mental anxiety, or grief will demand mental rest, change of scene.

When the habit of sleeplessness has become we it may require more than the removal of the cau complete cure. Simple measures, however, shou tried first before resorting to hypnotics. The bed be quiet, well ventilated, and of moderate tempera the feet are cold the blood should be diverted fr by hot foot-baths, which may be made more eff addition of mustard. Vigorous rubbing of the useful. A glass of hot milk, a cup of bouillon, o before retiring often acts favorably as a derivati persons light reading for half an hour, in others will invite sleep. In neurasthenia, massage and t use of the wet-pack are invaluable aids.

Hypnotic drugs must be used with caution. Their continued exhibition predisposes to invalidism and favors the development of vicious habits. In simple habitual insomnia they should not be prescribed until general measures have been tried and found wanting.

The chief somnifacients are:

| | |
|---|---|
| Opium. | Sulphonal. |
| Cannabis indica. | Trional. |
| Hyoscin. | Paraldehyd. |
| Hydrated chloral. | Urethan. |
| Chloralformamid (chloralamid). | Hedonal. |
| Chloralose. | Veronal. |
| Chloretone. | Bromids. |

## OPIUM, U. S. P.

Opium is the inspissated juice obtained by incising the unripe capsules of *Papaver somniferum*, a poppy indigenous in Western Asia. To be up to the official standard, it should contain not less than 9 per cent. of crystallized morphin. It appears in the form of irregular lumps, having a dark-brown color, a gummy consistence, a peculiar narcotic odor, and a bitter taste. In addition to *meconic acid* and a neutral principle, *meconin*, it contains a number of alkaloids, the most important of which are *morphin*, *codein*, *thebain*, *papaverin*, *narcotin*, and *narcein*.

| PREPARATIONS. | DOSE. |
|---|---|
| Opium, U. S. P. (9 per cent. of morphin) | ½–2 gr. (0.03–0.13 gm.). |
| Opii Pulvis, U. S. P. (12–12.5 per cent. of morphin) | ½–2 gr. (0.03–0.13 gm.). |
| Opium Deodoratum, U. S. P. (denarcotized opium, 12–12.5 per cent. of morphin) | ½–2 gr (0.03–0.13 gm.). |
| Opium Granulatum, U. S. P. (12–12.5 per cent. of morphin) | ½–2 gr. (0.03–0.13 gm.). |
| Pilulæ Opii, U. S. P. (1 gr.—0.06 gm. of powdered opium in each) | 1–2 pills. |
| Extractum Opii, U. S. P. (20 per cent. of morphin) | ¼–1 gr. (0.016–0.65 gm.). |
| Tinctura Opii, U. S. P. (laudanum; 10 per cent. of granulated opium; 100 c.c., contain 1.2 to 1.25 gm. of morphin) | 5–20 min. (0.3–1.2 c.c.). |
| Tinctura Opii Deodorati, U. S. P. (10 per cent. of granulated opium; 100 c.c., contain 1.2 to 1.25 gm. of morphin) | 5–20 min. (0.3–1.2 c.c.). |
| Tinctura Opii Camphorata, U. S. P. (paregoric; contains camphor, benzoic acid, oil of anise, and about 2 gr.—0.12 gm. of powdered opium per ounce) | ½–4 fl. dr. (1.8–15.0 c.c.). |
| Tinctura Ipecacuanhæ et Opii, U. S. P. | 5–15 min. (0.3–1.0 c.c..) |
| Acetum Opii, U. S. P. (black drop; 10 per cent. of powdered opium) | 5–20 min. (0.3–1.2 c.c.). |

| PREPARATIONS. | Do |
|---|---|
| Vinum Opii, U. S. P. (10 per cent. of granulated opium) | 5–20 min. ( |
| Pulvis Ipecacuanhæ et Opii, U. S. P. (Dover's powder; contains 10 per cent. of powdered opium; 10 per cent. of ipecac; and 80 per cent. of sugar of milk) | 5–10 gr. (0.3– |
| Trochisci Glycyrrhizæ et Opii, U. S. P. (each contains $\frac{1}{12}$ gr.—0.005 gm. of powdered opium). | |
| Emplastrum Opii, U. S. P. (6 per cent. of extract of opium). | |

Morphin is the chief alkaloid of opium and i physiologic activity. It occurs in white prismati fine needles, of a bitter taste, and very slightl water. The salts of morphin, being much more the alkaloid itself, are generally prescribed.

The following alkaloids of opium and their pre used medicinally:

| PREPARATIONS. | Do |
|---|---|
| Morphina, U. S. P. | $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.00 |
| Morphinæ Acetas, U. S. P. | $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.00 |
| Morphinæ Hydrochloridum, U. S. P. | $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.00 |
| Morphinæ Sulphas, U. S. P. | $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.00 |
| Pulvis Morphinæ Compositus, U. S. P, (Tully's powder; contains licorice, camphor, calcium carbonate, and morphin sulphate) | 5–10 gr. (0.3- |
| Codeina, U. S. P. | $\frac{1}{2}$–2 gr. (0. |
| Codeinæ Sulphas, U. S. P. | $\frac{1}{2}$–2 gr. (0. |
| Codienæ Phosphas, U. S. P. | $\frac{1}{2}$–2 gr. (0. |

The following compounds are derived from of opium. From morphin: apomorphin (see p. dionin, and peronin; from codein: apocodein (see from narcotin: cotarnin hydrochlorid (see p. 380

**Physiologic Action.—Nervous System.**— dominant action of opium is on the cerebrum. doses the drug diminishes all sensations, especi pain, and causes drowsiness. In full therapeutic duces natural sleep, from which the patient us refreshed, but not rarely complaining of dull h nausea. Toxic doses are followed by profoun some instances the narcotic effect is preceded by of exaltation or exhilaration, with increased play nation. This excitement, as in the case of alc rather upon depression of the controlling centers t direct stimulation of the psychic functions. U opium has little action, except in large doses, cells of the brain cortex.

Opium increases to some extent the reflex irritability of the spinal cord. In human beings this action is rarely apparent, owing to the much greater sensitiveness of the brain to the influence of the drug, but in animals, like the frog, in which the cerebral hemispheres are poorly developed, large doses give rise to tetanic convulsions. In some of the opium alkaloids, particularly thebain and laudanin, the convulsant action is predominant.

On the peripheral sensory and motor nerve-endings opium has little or no effect.

**Respiratory System.**—Opium is a powerful depressant of the respiratory center in the medulla. In poisoning, the respirations become progressively weaker and fewer, and if the dose has been sufficiently large, finally cease entirely.

**Eye.**—Applied to the conjunctiva, morphin has no effect upon the pupil, but when administered internally in toxic doses it causes extreme myosis through a central action. In fatal poisoning, dilatation of the pupil is observed just before death as a result of the asphyxia.

**Circulatory System.**—Opium dilates the peripheral cutaneous vessels and causes flushing, sweating, and occasionally itching; otherwise it has little effect on the circulation. In poisoning, the pulse at first is full and somewhat infrequent, and later it is feeble and frequent, but these changes are chiefly the result of the asphyxia.

**Secretions.**—All the secretions, except the sweat, are diminished by opium.

**Alimentary Canal.**—In man medicinal doses of opium lessen peristaltic movements, probably by depressing some part of the nervous mechanism in the bowel wall. To this action and the diminished intestinal secretion the well-known constipating effect of the drug is to be attributed. Very large amounts of morphin, especially if introduced directly into the blood, sometimes increase peristaltic movements and induce purgation, probably by depressing the inhibitory nerve of the bowel.

**Metabolism.**—Morphin decreases to some extent the absorption of oxygen and the excretion of carbonic acid. By interfering with respiration and oxidation it sometimes causes slight glycosuria.

**Elimination.**—Morphin escapes from the body chiefly through the stomach and bowel, only minute quantities appearing in the urine. Elimination is rapid, and even after hypodermic injection the drug may be found in the stomach within a few minutes. Ordinarily only a small amount of the mor-

phin injected is oxidized in the tissues, but un
doses the proportion is gradually increased, so th
only traces appear in the excreta.

**Conditions Modifying the Action of O**

tain symptoms and diseases counteract the narc
opium, and when these are present the drug ma
much larger doses than are generally prescribed;
suffering from diabetes or affections attended wit
such as acute peritonitis, renal or biliary colic, c
take with advantage doses that under other
would produce profound narcosis. On the othe
there are evidences of nephritis the drug must
great caution, since small doses not infrequently
effects.

Age and sex modify its action. Children, o
the sensitiveness of their nervous systems, are p
ceptible to opium, so that it must be given in
than the age would naturally indicate. A drop
has produced a fatal result in a child less tha
old. Its action is more pronounced on women
and in the former it is more apt to cause disag
effects.

Patients rapidly acquire a tolerance of the
frequent repetition of the dose, so that habitués
enormous amounts without experiencing the usu

**The Action of Opium and Morphin C**

Apart from being more powerful than opium, m
from the latter in having a less constipating, les
and less diaphoretic effect.

**Toxicology.**—Acute Opium-poisoning.—U
is very large, there may be at first a stage of
which the imagination is stimulated and the fe
alted. This stage is soon followed by one of
which the patient becomes listless and drowsy, a
into a deep sleep. The pulse is slow and full,
contracted to a pin-point size, the respirations
labored, the muscles are relaxed, and the face is
stage it is still possible to arouse the patient b
flagellation, or shaking. In the third stage con
the pulse is rapid and irregular, the skin is cla
breathing is shallow and irregular. Finally,
from paralytic asphyxia.

*Treatment of Acute Opium-poisoning.*—The st
be emptied by means of the stomach-pump or
emetic, such as zinc sulphate or mustard flour

phin is eliminated by the stomach and then reabsorbed, lavage should be repeated at short intervals. Black coffee may be given by the mouth or by the rectum; it promotes wakefulness and also stimulates respiration. The best chemical antidote is potassium permanganate; 3 to 5 grains (0.2-0.3 gm.) of this drug, dissolved in a glassful of water, should be given at once and repeated in thirty minutes. Tannic acid is also recommended as a chemical antidote. The best physiologic antidotes are the powerful respiratory stimulants, such as atropin, strychnin, and caffein; one or all of these may be given hypodermically in full doses.

Artificial respiration is of the greatest value, and should be maintained so long as the beating of the heart continues. It is necessary that the patient should be aroused and kept awake, so that he himself can aid in keeping up respiration. Flicking with a wet towel, the use alternately of hot and cold water, and the application of the faradic current are among the measures that may be employed in staving off sleep. In carrying out the treatment it is important to avoid chilling or exhausting the patient.

**Chronic Poisoning** (*Morphinomania, Morphinism*).—The symptoms resulting from the habitual use of opium are an irresistable craving for the drug, loss of flesh and strength, tremors, anemia, a peculiar sallow complexion, anorexia, deranged digestion, a tendency to diarrhea, disturbed sleep, mental depression, irritability, and a characteristic propensity for lying and deceiving.

*Treatment of Chronic Opium-poisoning.*—Isolation in a special institution or asylum is almost imperative. As a rule, the drug should be withdrawn rapidly, but in aggravated cases not too abruptly for fear of collapse. The diet should consist of nutritious, easily digested food. Strychnin, while it is without specific action, is often extremely valuable for its stimulating effect. Bromids and cannabis indica are sometimes useful in ameliorating the distress which follows the withdrawal of opium. Sulphonal, paraldehyd, and veronal are the best somnifacients. Massage, graduated exercise, and the Turkish bath are useful roborant measures in the convalescent stage.

**Therapeutics.**—Opium is used to relieve pain and distress; to induce sleep; to allay peripheral irritation; to check excessive secretion; to promote diaphoresis; to control convulsions; and to check hemorrhage.

**To Relieve Pain and Distress.**—Opium is by far the best analgesic that we possess. In allaying the severe pain of gross lesions—*fractures, malignant growths,* and *acute inflam-*

*mation* of serous membranes—it has no rival. I
and other forms of recurrent pain it should be
after all other measures have failed, and then w
caution, since the danger of forming the opium-h
cases is very great. In the painful crises of *locon*
its use may become imperative. Osler regarc
hypodermically, as the most useful drug in thos
*angina pectoris* in which amyl nitrite proves ineffe

In various forms of *colic*—renal, biliary, and int
well to combine atropin with morphin, since the
the latter in relaxing the spasm.

Acute inflammation of the brain and its membr
be considered, as was formerly the case, a contrai
the use of opium; indeed, in *cerebrospinal feve*
forms of *acute meningitis* it may be the only reme
afford relief from the intense suffering. In mo
*acute appendicitis* morphin should be withheld, si
the symptoms and thus interferes with an accura
the local conditions.

In *acute melancholia* and other psychoses ass
profound mental anxiety, opium often exerts a
calmative effect. In many cases of *chronic heart-*
invaluable in relieving the general discomfort
moting sleep. To obtain the best results, howev
be given hypodermically.

**To Induce Sleep.**—While opium will relieve *in*
almost any cause, it is especially suitable when t
the sleeplessness is *pain*. It is also useful as a
in *continued fevers*, like typhoid fever, in *deliri*
and in *chorea*, when the movements prevent sle

Occasionally, owing to some peculiar idiosync
causes excitement and wakefulness instead of slee
of *extreme nervous excitement* chloral is generall
opium, but not infrequently better results are obt
combination of opium with chloral than from
singly.

**To Allay Peripheral Irritation.**—No remedy
as opium or one of its derivatives in relieving t
*cough* of bronchitis and phthisis. It should not b
however, in pulmonary affections when the exp
copious, and in *pulmonary edema* it is a dangerou
*asthma* morphin hypodermically, with or without
reliable remedy. In some cases of *acute vomitin*
of the drug act happily, but in the *pernicious vomi*
*nancy* its effects are not good. In *chordee* and i

*abortion* is frequently employed in the form of suppositories, but it acts just as well when given by the mouth or hypodermically.

**To Check Excessive Secretion.**—In *acute inflammatory affections of the bowel*, after irritating matters have been removed, opium is often serviceable in checking the excessive secretion. In *cholera infantum* hypodermic injections of morphin ($\frac{1}{100}$ gr.—0.00065 gm.) are sometimes of benefit.

In *diabetes mellitus* it does more good than any other remedy, and as the disease establishes a tolerance for the drug, it should be given in ascending doses until it induces favorable or untoward results. The manner in which it acts in this disease is unknown. Codein is preferred by some practitioners to morphin and opium, since it causes less disagreeable after-effects. In *diabetes insipidus* the drug is of far less value.

**To Promote Diaphoresis.**—In the beginning of "colds," and in so-called *muscular rheumatism*, it is useful for its sudorific effect. In these cases Dover's powder is the best preparation, since the ipecac which it contains assists the opium in promoting diaphoresis.

**To Control Convulsions.**—Morphin hypodermically is of service in controlling the painful spasmodic seizures of *tetanus*. Mackenzie, Loomis, and Osler speak favorably of its action in the convulsions and other nervous manifestations of *uremia*, and unquestionably it may be given with great benefit in many cases, but it should always be employed with considerable caution, especially when there are evidences of chronic interstitial nephritis.

Flechsig's method of using opium in the treatment of epilepsy is occasionally of service in old and obstinate cases. This method consists in giving opium in large doses for a period of six weeks (beginning with 1 grain of the extract the dose is rapidly increased until 15 grains a day are taken at the end of the first week, this amount being kept up for six weeks). The opium is abruptly withdrawn and potassium bromid is substituted. Large doses of the latter drug (30 grains three times a day) are given for about two months, and are then gradually reduced until less than 40 grains a day are being taken.

**To Check Hemorrhage.**—It is a common practice to combine opium with hemostatics in the various hemorrhages, such as *hemoptysis*, *hematemesis*, and *enterorrhagia*. The good which it accomplishes is probably the result of its calmative influence on the nervous system.

**External Use.**—In the form of a lotion it is extensively em-

ployed as a sedative application in *sprains*, *bruises*, *articular rheumatism*, and *erysipelas*, but any other weak alcoholic preparation would probably be quite as efficient, since opium itself has no effect on the sensory nerve-endings. In these cases, notwithstanding the chemical incompatibility of the two drugs, it is generally combined with lead subacetate, as in the following formula:

℞ Tincturæ opii,
Liquoris plumbi subacetatis, ăă ℥ij;
Aquæ, q. s. ad Oj.—M.

**Untoward Effects.**—In some persons the use of opium, even in moderate doses, is followed by headache, depression, anorexia, nausea, and vomiting. In others, on account of a peculiar idiosyncrasy, it causes excitement and wakefulness instead of sleep. In rare instances it occasions general pruritus or an erythematous rash.

**Contraindications.**—Opium should not be used in pulmonary affections associated with embarrassed respiration, such as edema, and pneumonia during the stage of consolidation. For reasons already mentioned it is best to withhold it in appendicitis. When chronic nephritis exists it must be used with the utmost circumspection.

**Administration.**—When a prompt analgesic effect is desired, one of the salts of morphin should be selected in preference to opium, and should be administered hypodermically. When large doses are required it is well to add a small dose of atropin ($\frac{1}{150}$ gr.—0.0004 gm.) to each injection. Pulverized opium, deodorized opium, and the extract are suitable preparations for use in pills. Dover's powder is the best preparation for promoting diaphoresis. The most agreeable liquid preparations are the deodorized tincture and paregoric. Paregoric, on account of its weakness and pleasant taste, is especially suitable for children. The disagreeable after-effects of opium are often prevented by combining with it potassium bromid.

Children are extremely intolerant to the drug in all forms, and, in consequence, the dose must be considerably less than the age would apparently justify.

**Incompatibles.**—Ammonia, alkaline carbonates, preparations containing tannic acid, or salts of the metals should not be prescribed in solution with morphin. Chlorids, bromids, iodids, and borates, when present in large amount, precipitate morphin from solutions. Even dilute hydrocyanic acid may slowly precipitate from solutions of morphin an insoluble cyanid of the alkaloid.

### CODEINA, U. S. P.

Among the alkaloids of opium codein ranks next in importance to morphin. It occurs in the form of colorless crystals, of a bitter taste, and soluble in 88 parts of water and in 1.6 parts of alcohol. The sulphate and phosphate are to be preferred to the alkaloid itself, on account of their greater solubility. The phosphate, being soluble in 2.25 parts of water, is adapted to hypodermic use.

Codein resembles morphin in its action, but it is far less powerful as a hypnotic and analgesic. It is less liable, however, than morphin to induce nausea and constipation. It is an excellent remedy for allaying irritative cough in *bronchitis* and *phthisis*. It is preferred by some clinicians to opium in the treatment of *diabetes*, but, as a rule, the crude drug or morphin will be found more efficacious.

### HEROIN.

Heroin is the diacetyl ester of morphin. It appears as a white crystalline powder, of slightly bitter taste. It is insoluble in water, but freely soluble in acidulated solutions. It has a more depressant action on the respiratory center than morphin, but is less powerful than the latter as an analgesic and a somnifacient. The dose is from $\frac{1}{12}$–$\frac{1}{8}$ gr. (0.005–0.008 gm.). Large doses are frequently followed by nausea, headache, dryness of the throat, vertigo, diplopia, and numbness of the limbs.

Heroin is useful in allaying the cough of *bronchitis* and *phthisis*, although it is not so generally efficacious as codein. In *emphysema* and *asthma* it is an excellent sedative. It may be given in pill, powder, or in water to which a little acid has been added. The hydrochlorid of heroin is freely soluble, and may be given in aqueous solution by the mouth or hypodermically. Heroin is incompatible with alcoholics, acids, and apomorphin.

### DIONIN.

Dionin is the ethyl ester of morphin hydrochlorid. It is freely soluble in water. According to Winternitz, it does not depress the respiration, and it has no unpleasant effect upon the stomach. As an analgesic and a somnifacient it is far less powerful than morphin; as a sedative it stands probably midway in efficiency between codein and morphin. It may be prescribed in the same dose as codein.

As a local remedy dionin has been well recommended as an analgesic and absorbent in certain diseases of the eye, such as *iritis*, *interstitial keratitis*, and *corneal opacities*. As it does not

affect sensibility, it is not suited for use in operat
eye. It is usually employed in the form of a 5 or
solution or a 10 per cent. ointment. The eye rapi
tolerance for the drug, hence little effect is to be s
its use for a longer period than a week or ten day
should be warned that the first instillation often cau
swelling of the conjunctiva and eyelids. This soo
and is of no serious import.

### PERONIN.

Peronin is the hydrochlorid of the benzyl ester
It was first studied by von Mering, who found it
than morphin, but freer from disagreeable after-eff
researches indicate that, while it is a somewhat mo
sedative than codein, it is also more toxic. A suf
ber of clinical observations have not yet been made
the exact rank of peronin as a therapeutic agent,
of its slight solubility, unpleasant taste, and rel
toxicity, it would seem to have few, if any, adva
codein. The dose is from $\frac{1}{3}$–1 gr. (0.02–0.06 g

## CANNABIS INDICA, U. S. P.

(Indian Hemp; Hashish.)

The flowering tops of an East Indian plant, *Can*
It contains a resinous principle known as *cannabin*

| Preparations. | Dose. |
|---|---|
| Tinctura Cannabis Indicæ, U. S. P. . . . | 10–30 min. (0.6– |
| Fluidextractum Cannabis Indicæ, U. S. P. | 1–5 min. (0.06–0. |
| Extractum Cannabis Indicæ, U. S. P. . . | $\frac{1}{3}$–1 gr. (0.008–0 |

**Physiologic Action.**—In large doses it produ
tion of mental exhilaration associated with halluc
disordered consciousness of time, locality, and
This stage of excitement finally gives way to sleep
last several hours. Sensation is perverted and be
before sleep is induced there is often more or less
thesia. Upon the circulatory and respiratory syste
has little influence unless given in very large dose

Although alarming symptoms sometimes follo
of cannabis indica, no death from its use has been

**Therapeutics.**—Cannabis indica is used chie
analgesic, sedative, and hypnotic. Although muc
opium, it may replace the latter when, for any
more active drug is unavailable. It is often eff

persistent cough of *chronic bronchitis* and *phthisis*, in the dyspnea of *asthma*, and in the restlessness and insomnia of *chronic nephritis*. As an analgesic it is very valuable in certain forms of *neuralgia*, especially *migraine*, in which affection it is not only useful between, but also during, the paroxysms. It is occasionally effective in relieving the violent pains of *locomotor ataxia*. It may be employed as an adjuvant to chloral in *tetanus*. In some forms of *dysmenorrhea* and *menorrhagia* it proves serviceable. In combination with the bromid of potassium it is sometimes useful in *mania* and *delirium tremens*.

Sée and Suckling have strongly recommended it in *gastralgia*.

**Administration.**—As the preparations of cannabis indica vary considerably in strength, and as some individuals are far more susceptible to the action of the drug than others, it is always advisable to begin with small doses and to increase them gradually. A dose of 10 drops of the tincture, repeated in four hours, has caused in an adult intense excitement, dilatation of the pupils, and disordered sensation.

As the addition of water or of an aqueous liquid to the fluid extract or tincture precipitates the resinous principle, an alcoholic menstruum should be selected for these preparations, or, in case water is used, enough mucilage should be added to hold the resin in suspension.

## CHLORALUM HYDRATUM, U. S. P.

(Hydrated Chloral; Chloral, $C_2HCl_3O + H_2O$.)

Hydrated chloral is obtained from the union of a molecule of water with trichloraldehyd (chloral), the latter being a product of the action of chlorin on alcohol. It occurs in the form of colorless, transparent crystals, having a bitterish, caustic taste, a pungent odor, and a neutral reaction. It is freely soluble in water, alcohol, ether, and chloroform. The dose is from 10–20 gr. (0.65–1.3 gm.).

**Physiologic Action.**—**Nervous System.**—The dominant action of chloral is on the central nervous system. In moderate doses (15–20 gr.—1.0–1.3 gm.) it depresses the cerebrum without sensibly disturbing the circulation and respiration, and produces a natural sleep lasting from four to eight hours. Unlike morphin, it has but little effect on the algesic centers of the brain, and, therefore, pain antagonizes its soporific action. Larger doses of chloral (30–40 gr.—2.0–2.6 gm.) depress all the cerebral centers, including the motor, and cause profound sleep. Doses of this size also diminish the reflex excitability of the spinal

cord and depress the respiratory and vasomotor ce
medulla. Toxic doses produce all the phenomena
chloroform-poisoning. On the peripheral nerves
little or no action.

**Circulatory System.**—Moderate doses of chl
affect the circulation, but large doses lower the blo
by depressing the vasomotor center and the cardia

**Respiratory System.**—The respiration is not
ordinary doses of chloral, but after large doses it
frequent and shallow, and, finally, ceases from para
respiratory center.

**Temperature.**—Toxic doses lower the temper
lating the cutaneous vessels, by decreasing mus
ments, and probably also by depressing the heat ce
brain.

**Metabolism.**—The prolonged use of chloral is
increased destruction of proteids and fatty degener
viscera.

**Local Action.**—Locally, chloral is an active
pecially to mucous membranes. Unless taken in
tion it is very likely to cause nausea and vomiting.

**Action on Lower Organisms.**—Chloral preven
ments of protozoa and retards the putrefaction
solutions.

**Elimination.**—Chloral circulates in the blood
and is eliminated by the kidneys as urochloric a
taken in excess it escapes in part unchanged. U
ing urochloric acid responds to Fehling's test for s

**Toxicology.**—The characteristic features of a
poisoning are sleep, deepening into coma, a
pulse, slow breathing, followed by rapid shallo
contracted pupils, followed by dilated pupils, mu
ation, and collapse. Death usually results from
paralysis.

**Treatment of Poisoning.**—The temperature
maintained by external heat. Brunton and Str
that an animal would stand a very much larg
chloral when the body-temperature was kept u
than when it was allowed to fall. The patient
aroused by friction, flagellation, douches, etc., but
be shaken or forcibly made to walk, as in opium-p
account of the danger of heart-failure. Cardiac
tory stimulants like strychnin, atropin, ammonia, a
should be given freely. Artificial respiration sh
sorted to early, before the development of asphyx

**Chronic Poisoning** (*Chloralism*).—The chief symptoms of chronic chloral-poisoning are nervousness, dyspnea, palpitation, insomnia, mental impairment, and a group of phenomena apparently due to vasomotor disturbance, such as temporary lividity, erythematous rashes, ecchymoses, and edema.

**Therapeutics.**—Chloral is used chiefly to induce sleep and to allay spasm.

**Somnifacient.**—It is a valuable somnifacient, inducing quiet and refreshing sleep. It is especially indicated for occasional use in the *insomnia* of overwork, excitement, sthenic fevers, delirium tremens, mania, and chronic nephritis. In sleeplessness resulting from pain it is much inferior to opium. In persistent insomnia it should be avoided, owing to the danger of habituation.

**Antispasmodic.**—It may be employed with advantage to arrest *uremic* and *puerperal convulsions*. In conjunction with the bromid of potassium it is perhaps the best sedative we possess in the *convulsions of tetanus* and *strychnin-poisoning*. In grave cases of *epilepsy*, in *whooping-cough* attended with violent paroxysms, and in *chorea insaniens* chloral is often useful, but in the milder manifestations of these diseases it should not be selected, on account of the depressing effect which follows its continued use.

When equal parts of chloral and camphor are rubbed together a clear syrupy liquid is formed, which is termed *chloral camphor*. It is used as a local anesthetic in *neuralgia* and *toothache*. In the form of an ointment, 30–60 gr. to the ounce (2.0–4.0 gm. to 30.0 gm.), it is useful in *pruritus*.

**Contraindications.**— Marked cardiac and respiratory weakness are contraindications to the use of chloral. In the chronic neuroses it must be given with considerable caution, on account of the danger of inducing the chloral habit.

**Administration.**—It is best given dissolved in some agreeable vehicle, as in the following formula:

℞ Chlorali hydrati, gr. lxxx (5.2 gm.);
Tincturæ aurantii dulcis, f℥ss (2.0 c.c.);
Syrupi aurantii, f℥j (30.0 c.c.);
Aquæ, q. s. f℥ij (60.0 c.c.).—M.
Sig. A tablespoonful at bedtime. (*Insomnia.*)

Morphin and the bromids may be given with chloral to enhance its effect:

℞ Chlorali hydrati, gr. xvj (1.0 gm.);
Sodii bromidi, gr. xl (2.5 gm.);
Syrupi aurantii, f℥vj (22.5 c.c.);
Aquæ, q. s. f℥ij (60.0 c.c.).—M.
Sig. A dessertspoonful every four hours for a child of three years. (*Whooping-cough.*)

To lessen its irritant effect when given by the bowel, chloral should be mixed with some demulcent, such as milk.

**Incompatibles.**—Alkalies and strong solutions of antipyrin.

### BUTYL-CHLORAL HYDRAS.

(Butyl-chloral Hydrate, Croton-chloral Hydrate, $C_4H_5Cl_3O_1H_2O$.)

Butyl-chloral is an oily liquid formed by the action of chlorin on acetic aldehyd. It is converted into the solid butyl-chloral hydrate by the addition of water. Butyl-chloral hydrate occurs in the form of white pearly scales having a pungent odor and an acid, disagreeable taste. It is sparingly soluble in water, but freely so in glycerin and alcohol. The dose is from 5–20 gr. (0.3–1.3 gm.).

**Therapeutics.**—The action of butyl-chloral hydrate is much the same as that of chloral hydrate, except that it is less powerful and more irritant to the stomach. It is generally supposed that the fifth nerve is especially sensitive to its sedative influence, and therefore it has been extensively employed in the treatment of *trifacial neuralgia* and *migraine*.

On account of its nauseous taste, it is best given in capsules or in pills or dissolved in some aromatic mixture. Solutions should be freshly made when wanted, as the drug gradually decomposes when dissolved. It is incompatible with alkalies.

### CHLORALFORMAMIDUM, U. S. P.

(Chloralformamid, Chloralamid, $CCl_3CH(OH).CONH_2$.)

Chloralformamid, or chloralamid, is a synthetic compound formed by the union of chloral with formamid. It occurs in the form of colorless crystals, having a bitter taste, and soluble in 18 parts of water and $1\frac{1}{2}$ parts of alcohol. The dose is from 10–30 gr. (0.65–2.0 gm.).

**Physiologic Action.**—The dominant action of chloralformamid is upon the cerebrum, which it depresses, causing profound sleep. Unlike chloral, it has little effect on the circulation, and is only a feeble depressant to the spinal cord. The experiments of Wood and Cerna indicate that it rather stimulates than depresses the respiratory center. It is slowly broken up in the organism into chloral and formamid, the latter, owing to its stimulant properties, counteracting to some extent the depressant action of chloral on the circulation. It is excreted as urochloralic acid.

**Therapeutics.**—Chloralformamid is a pure hypnotic, less depressing and less irritating to the stomach than chloral, but at the same time less powerful and less prompt in its action.

It is not so slow in its action as sulphonal, and it is less liable than that drug to cause languor and drowsiness next day. Headache, giddiness, exhilaration, nausea, and inco-ordination are occasionally observed after its use. It has no cumulative effect, and patients do not readily become addicted to its use. It is an excellent somnifacient in *chronic heart, lung,* and *kidney disease,* in *hysteria, neurasthenia, delirium tremens, senility,* and *acute fevers.* When wakefulness is due to pain, opium is a better remedy, although chloralformamid seems to possess some analgesic properties. It has been highly recommended as a sedative in *cardiac asthma,* and, in combination with potassium bromid, as a superior remedy in *sea-sickness.*

**Administration.**—Chloralformamid should be given about half an hour before bedtime. On account of its bitter taste and imperfect solubility it is better not to prescribe it in the form of powders. It may be conveniently given in some aromatic aqueous vehicle, to which a little alcohol or weak acid has been added to facilitate solution. It is decomposed by hot water.

℞ Chloralformamidi, gr. lxxx (5.2 gm.);
Elixiris aromatici, f℥j (30.0 c.c.);
Aquæ, q. s. ad f℥ij (60.0 c.c.).—M.
Sig. A tablespoonful in water half an hour before bedtime.

**Incompatibles.**—Alkalies convert it into chloral.

## CHLORALOSE.

(Anhydroglucochloral, $C_8H_{11}Cl_3O_6$.)

Chloralose is a compound prepared by subjecting a mixture of equal parts of anhydrous chloral and glucose to a temperature of 212° F. for one hour. It appears in the form of fine colorless crystals having a bitter, disagreeable taste. It is freely soluble in hot water and in alcohol, and slightly so in cold water. The dose is from 5–8 gr. (0.32–0.5 gm.).

**Physiologic Action.**—Chloralose, like chloral, induces sleep by directly depressing the brain. During sleep the reflex excitability is not diminished, but rather exaggerated, indicating that in ordinary doses the drug does not depress the spinal cord. Its somnifacient effect cannot be due to chloral set free in the alimentary canal, since chloralose is active in less than half the dose of the older hypnotic. It has little effect on the sensory nervous system, and is, therefore, only a feeble analgesic. Small doses do not generally affect the circulation, but large doses depress the heart.

The great drawback to the general use of chlo irregularity of its action; it often acts very promp a refreshing sleep, lasting from six to eight ho infrequently alarming symptoms follow its exhib small doses. The untoward effects are retarda pulse, dilatation of the pupils, deafness, tremo prostration, cyanosis, incoherent speech, convuls nausea, profuse sweating, and incontinence of uri In neurotic subjects it may induce delirious excite of sleep.

**Therapeutics.**—Chloralose has been used wi cess in *functional insomnia*. Tyson has found i the sleeplessness of *chronic heart-disease* and *Bri* Balfour also speaks favorably of its action in t associated with *heart-disease*. The drug should when there is great debility.

**Administration.**—Chloralose is best adm cachets or capsules, followed by a draught of hot

## CHLORETONE.

(Aneson, Trichlortertiary Butyl Alcohol, $CCl_3C(CH_3)$

Chloretone is a compound formed by the additi potash to equal weights of chloroform and acet white crystalline powder, with a camphoraceous oc It is sparingly soluble in cold water, but freely so strong alcohol. The dose is from 5–20 gr. (0.3–1

**Physiologic Action.**—Chloretone has tw actions: it is a somnifacient and a local anesth mals large doses reduce the temperature and al blood-pressure, probably by depressing the heart a motor center. Impens considers the drug to be than chloral. It probably undergoes decompo body, since after its ingestion neither chloretone components (chloroform and acetone) are found It has pronounced germicidal properties.

**Therapeutics.**—Chloretone may be regarded ably safe hypnotic of moderate power. It is p action, sleep usually following in from half an hour after its administration. Beyond causing s ness on the day following its exhibition, it rarely unpleasant after-effects. Toleration of the dru rapidly acquired by continuous use. It is especi for use in cases of *insomnia unattended with seve fever*, or *pronounced nervous excitement*. It has be some success as a sedative in *sea-sickness* and *noctu*

As a local anesthetic and antiseptic it has proved serviceable in minor surgery. It may be applied in the form of a dusting-powder to *wounds*, *burns*, and *painful ulcers*.

Chloretone (5 per cent.) serves as a preservative of solutions of organic compounds (adrenalin, homatropin).

**Administration.**—It may be given in tablets, cachets, or powders, followed by a draught of water.

## SULPHONMETHANUM. U. S. P.

(Sulphonmethan, Sulphonal, $(CH_3)_2C(SO_2C_2H_5)_2$.)

Sulphonal is a synthetic compound obtained by oxidizing a mixture of ethyl hydrosulphid and acetone. It occurs as a colorless, crystalline powder, free from odor and taste. It is soluble in 360 parts of cold water, 15 parts of boiling water, and 47 parts of alcohol. The dose is from 15–30 gr. (1.0–2.0 gm.).

**Physiologic Action.**—In moderate doses sulphonal is a pure hypnotic, inducing sleep by a direct action on the cerebrum. Owing to its insolubility in gastric juice it is very slowly absorbed from the stomach, and when given in the form of a powder its soporific effect may not be manifest for several hours or, after a late dose, not until the following day. In ordinary amounts it does not influence the circulation or respiration, and rarely the digestion. Drowsiness, headache, vertigo, mental confusion, and cutaneous rashes are sometimes noted after its use. When exhibited in single doses, or in short courses not exceeding a week or two, sulphonal may be regarded as a safe hypnotic, rarely producing unpleasant symptoms. It has no analgesic properties.

**Toxicology.**—Acute sulphonal-poisoning does not commonly prove fatal, probably because much of the drug escapes from the stomach before absorbtion takes place. Neisser reports the case of a person who took a tablespoonful of the drug, and slept in consequence four days and nights, and then rapidly convalesced; and another patient, aged fifteen years, who took nearly 3 ounces and was unconscious for five days, recovering entirely in eight days.

Death, however, has followed the ingestion of comparatively small amounts. Murrell has cited two instances of death from 30 and 40 grains respectively.

The symptoms of acute poisoning are headache, vertigo, tinnitus aurium, marked cyanosis, vomiting, diarrhea, shallow breathing, feeble pulse, dilated pupils, unconsciousness, and collapse. The treatment consists in administering saline ca-

thartics and quickly acting stimulants (strychnin, ammonia), and in maintaining the body-temperature.

Chronic sulphonal-poisoning has frequently followed the continuous use of the drug for weeks or months. Seventeen out of 20 cases collected by H. C. Wood, Jr., terminated fatally. Probably from the gradual accumulation of the drug in the body the symptoms often appear abruptly, sometimes even after the habit has been suspended for several days. The chief phenomena of chronic poisoning are a peculiar red coloration of the urine, languor, ataxia, progressive weakness, paralysis, paresthesia, nausea, vomiting, colicky pains, serous diarrhea or obstinate constipation, insomnia, and mental confusion. In unfavorable cases the urine becomes scanty and albuminous, and the exhaustion deepens into collapse. In a fatal case reported by Taylor and Sailer well-marked degenerative changes were found in the liver, kidneys, and heart. The discoloration of the urine, which is of considerable diagnostic import, is due to the presence of hematoporphyrin, a compound thought to be derived from hematin.

The treatment of chronic poisoning consists in withdrawing the drug at once, and in freely administering alkaline carbonates (sodium carbonate) with saline cathartics. Hypodermoclysis and enteroclysis are also recommended by Wood.

**Therapeutics.**—It is an excellent hypnotic in the *insomnia of nervous excitement, overwork*, and *mental disease.* When sleeplessness is due to pain, it is ineffective. In chronic disease of the heart, lungs, or kidneys, sulphonal is not, as a rule, to be chosen.

**Administration.**—Sulphonal is best administered in some hot liquid, and, as its action is slow, it is well to give it an hour or two before bedtime. Compressed tablets should be avoided. On account of its tendency to accumulate in the body, it should not be given continuously for more than a week. Even after its exhibition for several successive days, it is advisable to order a saline cathartic for the purpose of removing from the bowel any portion of the drug remaining unabsorbed.

## SULPHONETHYLMETHANUM, U. S. P.

(Sulphonethylmethan, Trional, $(C_2H_5.CH_3.C(SO_2C_2H_5)_2.)$

Trional, like sulphonal, belongs to the group of "sulphones," *i. e.*, combinations of $So_2$ with organic radicles. Sulphonal, trional, and tetronal contain respectively two, three, and four molecules of ethyl. It occurs in the form of colorless, flat crystals, free from odor, and almost tasteless. It is

soluble in 195 parts of cold water, and freely soluble in hot water, ether, and alcohol. The dose is from 15–30 gr. (1.0–2.0 gm.).

**Physiologic Action and Therapeutics.**—The action of trional is almost identical with that of sulphonal. Owing to its greater solubility, however, it is more prompt in its effect, and has less tendency to accumulate in the body. When not used too continuously, it is a safe and reliable hypnotic, suitable for the same class of cases in which sulphonal is most effective. It is best given in some warm vehicle—milk, tea, or whisky—an hour or two before retiring. Occasionally it gives rise to headache, drowsiness, and nausea on the day following its administration. When used continuously for several weeks, it causes the following toxic symptoms: headache, vertigo, impairment of memory, disordered speech, tremors, nausea, constipation or diarrhea, colicky pains, hematoporphyrinuria, oliguria, and even strangury. These symptoms, however, do not, as a rule, develop so abruptly as they do after the prolonged use of sulphonal. The treatment does not differ from that of sulphonal-poisoning.

## TETRONAL.

$((C_2H_5)_2.C.(SO_2C_2H_5)_2.)$

Tetronal is an analogue of trional and sulphonal, containing four ethyl groups. It is used in the same doses and for the same purposes as trional. It has no advantages over the latter; on the contrary, it is less soluble and much more costly.

## PARALDEHYDUM, U. S. P.

(Paraldehyd, $C_6H_{12}O_3$.)

Paraldehyd is a product obtained by treating aldehyd with dilute sulphuric or nitric acid. It appears as a colorless liquid, having a strong ethereal odor and a disagreeable, pungent taste. It is soluble in 8.5 parts of water, and is miscible in all proportions with alcohol, ether, chloroform, and oils. The dose is ½–1 fl. dr. (2.0–4.0 c.c.).

**Physiologic Action.**—The action of paraldehyd somewhat resembles that of chloral. Like the latter, it depresses the brain and spinal cord. Although it causes a sensible fall in the arterial pressure, it is not so depressing to the heart itself as chloral. Large doses are prone to disturb the stomach. It is eliminated by the lungs and kidneys. Toxic doses produce coma, feeble breathing, great muscular relaxation, abolition of

reflex activity, and, finally, death from paralysis o
tory center. Its long-continued use is sometimes
cutaneous eruptions. It has no analgesic propert

**Therapeutics.**—Paraldehyd is a safe and r
notic. The great drawbacks to its use are its unp
and the disagreeable odor which it imparts to th
twenty-four hours after its ingestion. Toleratic
what rapidly acquired. It may be employed with
in the *insomnia of mania, delirium tremens, hysteri
disease.* It is sometimes efficient as an antisp
*asthma.* It has also been used with some succes
ling the convulsions of *tetanus.*

**Administration.**—It may be prescribed in ca
some aromatic vehicle. A few drops of alcoh
freely miscible with water. The dose should be w

℞ Paraldehydi,
Glycerini,
Spiritus aurantii compositi, āā fʒiv
Aquæ, q. s. ad fʒij

**Sig.** A dessertspoonful in water, repeated in an hour if ne

## ÆTHYLIS CARBAMAS, U. S. P

(Ethyl Carbamate, Urethane, $NH_2.CO.OC_2H_5$.)

Ethyl carbamate, or urethane, is made by the in
ethyl alcohol and nitrate of urea. It occurs as colo
crystals, odorless, and having a cooling saline
readily soluble in water, alcohol, ether, and chlor
dose is from 15–45 gr. (1.0–3.0 gm.).

**Physiologic Action and Therapeutics.**—U
comparatively safe hypnotic, without influence
doses upon the respiration and circulation, but mil
what uncertain in action. It has no analgesic ef
doses are followed by coma, a fall of temperatu
of the pulse, abolition of reflex activity, and death
ratory paralysis. It is excreted as urea. It may be
employed in *insomnia from nervous excitement* or
is not without value as an anticonvulsant. Dana
have spoken very favorably of its action in son
*epilepsy.*

Urethane is incompatible with acids and alkalie
with chloretone it produces a liquid compound.

## HEDONAL.

(Methylpropylcarbinolurethane, $C_6H_{13}O_2N$.)

Hedonal is a synthetic compound closely allied to urethane. It occurs as a white crystalline powder, of a menthol-like taste, almost insoluble in water, but soluble in alcohol and ether. As a somnifacient it is more prompt and effective than urethane, but distinctly less powerful than chloral, trional, or sulphonal. It usually produces, within from ½ to 1 hour, quiet sleep, lasting from 4 to 8 hours, without unpleasant after-effects. It is an agreeable and safe somnifacient, only suitable, however, for very *mild forms of insomnia, unaccompanied by pain or excitement.* It is most effective in doses of from 20–30 gr. (1.3–2.0 gm.), in dry powder or in capsules.

## VERONAL.

(Diethylmalonylurea, Diethylbarbituric acid, $C_8H_{12}N_2O_3$.)

Like urethane and hedonal, veronal also belongs to the urea group of somnifacients. It is a white crystalline powder, of a faintly bitter taste, soluble in 145 parts of cold water and in 12 parts of boiling water. It appears to be a comparatively safe, prompt, and reliable somnifacient, producing, in from ½ to 1 hour a quiet sleep, lasting from 5 to 10 hours. Occasionally, its use is followed by lassitude, dulness, and anorexia. In a few cases toxic symptoms, such as somnolence, dryness of the throat, elevation of temperature, an erythematous rash, and prostration, have resulted from the repeated administration of the drug. It may be employed with advantage in cases of *simple insomnia, unaccompanied by pain* or *marked excitement.* The dose is from 8–15 gr. (0.5–1.0 gm.). It is best given in hot tea or milk, or in capsules followed by some warm liquid.

## POTASSII BROMIDUM, U. S. P.

(Potassium Bromid, KBr.)

Potassium bromid occurs in colorless or white cubical crystals, odorless, and having a pungent saline taste. It is soluble in 1.6 parts of water and in 200 parts of alcohol. The dose is from 10–60 gr. (0.65–4 gm.).

**Physiologic Action.**— **Circulatory System.**—Small doses have no influence, but large doses, owing to the presence of the potassium base, exert a depressant action on the heart.

**Nervous System.**—The bromid ion, irrespective of the base with which it is combined, depresses the entire central nervous system—cerebrum, spinal cord, and medulla—psychic, motor,

and sensory functions all being involved. By d
psychic centers it causes apathy, lapse of mem
fusion of thought; by depressing the motor area
it lessens the power of irritants to excite epilepti
sions; and by depressing the spinal cord an
diminishes reflex activity, blunts the sensibility of
membranes, and impairs muscular coördination.
of a bromid promote sleep by lessening the sen
the cerebrum to all centripetal stimuli. They al
abolish sexual feeling by a similar central action.

Wright and Crisafulli have found after pois
marked degenerative changes (vacuolation and at
cortical nerve-cells.

**Respiratory System.**—The respiratory center
other parts of the nervous system in the depressi
large doses of bromids, and in fatal poisoning res
fail before the heart ceases to beat.

**Alimentary Canal.**—In concentrated form po
mid acts as an irritant to the stomach, and r
nausea and vomiting.

**Absorption and Elimination.**—Potassium bro
absorbed, and may appear unchanged in the
fifteen minutes after its ingestion. Elimination i
as rapidly as absorption, hence there is a tendency
to accumulate in the body. Small quantities o
also excreted by the skin, respiratory tract, and b

**Bromism.**—The continuous use of bromids i
lowed by a group of symptoms to which the t
has been applied. This condition is characterize
a general eruption of acne, fetor of the breath, ga
ance, mental depression, somnolence, failure of m
tion of the sexual appetite, diminution of the refl
ment of tactile sensibility, unsteady gait, and muscu

**Exceptional Effects of Bromids.**—The co
bition of bromids in large doses is occasionally
one of the following symptoms: Paresis of the
depression of the heart, intense irritability of ter
sion of spirits, and suicidal or homicidal impuls

**Acute Poisoning.**—The chief symptoms re
the ingestion of a single toxic dose of potassiun
severe headache, inco-ordination, somnolence,
the pupils, burning in the stomach, and collap
case of bromid-poisoning has been reported.

**Action of Potassium Bromid Compared**
**Bromids.**—On account of the relatively large a

tassium (44 per cent.), this salt is the most powerful depressant of all the bromids.

**Therapeutics.**—Potassium bromid is used to control convulsions, to allay nervous excitement, to promote sleep, and to relieve certain forms of headache and neuralgia.

**To Control Convulsions.**—The bromids are by far the most useful drugs we possess in the treatment of *epilepsy*. They not only exert a direct sedative influence on the cerebral cortex, but through their action on the sensory neurons of the spinal cord they protect the brain from the disturbing influence of external stimuli. While they rarely effect a cure, they very often lessen materially the frequency of the paroxysms. The amount required varies with the severity of the case and the susceptibility of the individual, and must be determined experimentally in each case. Saturation is indicated by a loss of the palatal reflex, mental hebetude, and gastric disturbance. The daily dose usually ranges between 1 and 2 dr. (4.0–8.0 gm.). When larger doses than these are required, it is better to try a combination of other remedies with the bromid than to depend upon the latter alone. Sometimes small doses of potassium iodid, or moderate doses of antipyrin or acetanilid, will serve to lessen the amount of bromid required. A combination of several bromids often acts more satisfactorily than a single bromid. In *nocturnal epilepsy* the occasional exhibition of chloretone or sulphonal with the bromid often proves very efficacious. When the circulation is weak a combination of a bromid with digitalis or of adonis venalis, as recommended by Bechterew, will be found useful. It has been shown by Richet and Toulouse that the deprivation of salt from food very decidedly increases the efficacy of the bromid treatment. The addition of a drop or two of Fowler's solution to each dose of the bromid often prevents the outbreak of acne.

In some cases of epilepsy it is necessary to withhold the bromids entirely, since the general disturbance which they occasion more than counterbalances the good they accomplish in diminishing the number of seizures.

The bromids are of considerable value also in other *convulsive disorders* besides epilepsy, such as puerperal eclampsia, uremia, infantile convulsions, strychnin-poisoning, and tetanus. In severe cases of *chorea* with incessant movements the bromids may be employed, but they are less efficient than chloral. In local spasmodic affections—*whooping-cough*, *laryngismus stridulus*, and *essential asthma*—bromids are sometimes of service.

**To Allay Nervous Excitement.**—In nervous irritability of all kinds potassium bromid is useful. It is an excellent seda-

tive in the excitement of *overwork*, *worry*, and *a* also in that which attends hysteria. In the vari disturbances which attend the *menopause* it is our m remedy. In fully developed *delirium tremens* it value, but in the stage of excitement which precede it is very efficient.

Potassium bromid is a powerful anaphrodisiac; ishing the irritability of the sexual centers in the sp renders excellent service in *priapism*, *spermat* *nymphomania*.

Given for several days before the expected voya of from 10–20 gr. (0.65–1.3 gm.), three times a d prevents *sea-sickness*. It may also be tried in the *pregnancy*. Da Costa found that from 30–60 gm.) of potassium bromid, administered an hou dose of opium, would prevent the disagreeable of the latter.

**To Promote Sleep.**—As pure hypnotics the b feeble compared with opium and chloral, but in in to nervous excitement they frequently produce sleep.

**To Relieve Headache and Neuralgia.**—Potassi is often useful in attacks of *migraine*, *trifacial ne* the *headache of cerebral congestion*. In these affect be given alone or in combination with antipyrin, caffein, or a salicylic compound.

**Administration.**—Potassium bromid should solution, well diluted, after meals. In epilepsy it divide the daily dose according to the time at whic ures are likely to occur. Thus in nocturnal epileps tively small doses may be given early in the day, large dose (½–1 dr.—2.0–4.0 gm.) at supper-time. may be combined with antipyrin and Fowler's so the following formula suggested by Wood:

℞ Potassii bromidi,
Ammonii bromidi, āā ʒiij (12.0 g
Liquoris potassii arsenitis, fʒj (4.0 c.c.)
Antipyrinæ, ʒj (4.0 gm.)
Aquæ menthæ piperitæ, q. s. ad fʒvj (180.0
Sig. Tablespoonful in water night and morning.

In insomnia from nervous excitement potassium be combined with chloral, as in the following fo

℞ Chlorali hydrati, gr. xl (2.6 g
Potassii bromidi, ʒiss (6.0 gm
Aquæ et syrupi aurantii, āā q. s. ad fʒij (60.0 c.c
Sig. Tablespoonful in water at bedtime.

**Incompatibles.**—Potassium bromid is incompatible with acids and acid salts. It also precipitates certain alkaloids—morphin, quinin, and strychnin—from neutral solutions.

### AMMONII BROMIDUM, U. S. P.

(Ammonium Bromid, $NH_4Br$.)

Bromid of ammonium occurs in the form of white crystals or as a yellowish-white powder having a disagreeable salty taste. It dissolves in 1.2 parts of water and in 12.5 of alcohol. Its dose is from 20–60 gr. (1.3–4.0 gm.), well diluted.

**Physiologic Action.**—The dominant action of ammonium bromid, like the corresponding potassium salt, is on the nervous system. It depresses the cortical brain-cells, and both the sensory and motor neurons of the spinal cord, especially the former. It differs in its action from potassium bromid in being less depressing to the heart, muscles, and peripheral nerves.

**Therapeutics.**—It may be substituted with advantage for the potassium salt in all the conditions in which a bromid is indicated.

**Incompatibles.**—The same as in the case of potassium bromid, and, in addition, spirit of nitrous ether.

### SODII BROMIDUM, U. S. P.

(Sodium Bromid, NaBr.)

Sodium bromid occurs in colorless or white cubical crystals, or as a white granular powder, odorless, and of a saline, bitter taste. It is soluble in 1.7 parts of water and in 12.5 of alcohol. It contains 78 per cent. of bromin. The dose is from 20–60 gr. (1.3–4.0 gm.), well diluted.

**Physiologic Action and Therapeutics.**—Its action closely resembles that of potassium bromid, but it is less irritating to the stomach and somewhat less depressing. It may be used as a substitute for the potassium salt in the various conditions in which a bromid is indicated.

### STRONTII BROMIDUM, U. S. P.

(Strontium Bromid, $SrBr_2.6H_2O$.)

Strontium bromid occurs in colorless, very deliquescent, hexagonal crystals, odorless, and of a bitter, saline taste. It is readily soluble in water and in alcohol. The dose is from 30–60 gr. (2.0–4.0 gm.).

**Therapeutics.**—Strontium bromid has an action on the nervous system similar to that of the other bromids, but it is

less powerful. At the same time it is less depr
prone to cause acne, and, instead of disturbing the
tends rather to allay gastric irritation. It may b
succedaneum for other bromids when only a mi
required or when there is irritability of the stomacl
cases it may be combined with potassium or ammon
to mitigate their unpleasant by-effects. Germai
others have spoken favorably of its action in *gas*
*acid dyspepsia.*

### LITHII BROMIDUM, U. S. P.

(Lithium Bromid, LiBr.)

Lithium bromid is a white, granular, deliquescen
less, of a sharp, bitter taste. It is freely soluble i
in alcohol. The dose is from 20–60 gr. (1.3–4.0 g

**Therapeutics.**—Lithium bromid has a therap
about equal to that of sodium bromid.

### ACIDUM HYDROBROMICUM DILUTUM, U

(Diluted Hydrobromic Acid, HBr.)

Diluted hydrobromic acid is an odorless, colo
of acid properties, composed of 10 per cent. by wei
lute hydrobromic acid and 90 per cent. of water.
from 1–4 fl. dr. (4.0–15.0 c.c.), well diluted.

**Therapeutics.**—Hydrobromic acid has very
same action as the bromids. It differs from potas
in being less powerful, less likely to cause acne
depression, and in being more irritating to the

It may be given alone or in combination with
*epilepsy* and other convulsive disorders. It is esp
able in *tinnitus aurium* resulting from aural disease
the administration of quinin or salicylic compou
been employed as a sedative in *febrile excitemen*
*cough*, and *nervous headache.* The following co
dilute hydrobromic acid and horse-nettle is some
cious in the milder forms of epilepsy:

℞ Acidi hydrobromici diluti,
Fluidextracti solani carolinensis āā f℥iss (45.0 c
Syrupi aurantii, f℥j (30.0 c.c
Aquæ, q. s. ad f℥vj (180.0
Sig. A tablespoonful in water after meals.

### BROMOFORM, U. S. P.

(Bromoform; Tribrommethane, $CHB_3$.)

Bromoform is made by the action of hypobromi
on acetone, or of bromine on a mixture of methy

milk of lime. It appears as a clear, colorless liquid having a pleasant odor and a sweetish taste. It is sparingly soluble in water, but freely so in alcohol and glycerin. The dose is from 1–6 min. (0.06–0.4 c.c.). To be fit for use it should be free from color and acidity.

**Therapeutics.**— Bromoform has anesthetic properties somewhat analogous to those of chloroform, but as a therapeutic agent it is of interest chiefly as an internal remedy in *whooping-cough*. While it has a definite value in lessening the severity of the paroxysms, it has no power to shorten the duration of the disease.

**Toxicology.**—Many cases of poisoning by bromoform have been reported since its first introduction as a remedy for whooping-cough. Very often the accident has resulted from a lack of familiarity with the physical properties of the drug. As bromoform is heavier than mucilage, its suspension in the latter can only be temporary; it naturally tends to fall to the bottom of the bottle, and unless this is prevented by frequent and thorough shaking, a much larger dose may be taken on emptying the bottle than was intended. The chief phenomenon of bromoform-poisoning is a kind of intoxication, followed by coma, marked cyanosis, difficult breathing, a rapid, feeble pulse, muscular relaxation, and collapse. In some cases the coma has been interrupted by general convulsions. Death usually results from asphyxia.

**Treatment** consists in the evacuation of the stomach, the practice of artificial respiration, and the administration of cardiac and respiratory stimulants.

**Administration.**—It may be administered by simply dropping it on sugar or into a little peppermint-water. On account of its high specific gravity a minim is equal to about 6 drops. If suspended in mucilaginous liquids, the bottle must be well shaken before each administration. As it is soluble in alcohol and glycerin, a mixture of these liquids may be made the vehicle, as in the following formula:

℞ Bromoformi, ♏ xx–xxx (1.2–1.8 c.c.);
Alcoholis, ʒij (8.0 c.c.);
Spiritus menthæ piperitæ, ♏ xx (1.3 c.c.);
Glycerini, ʒij (60.0 c.c.).—M.
Sig.—A teaspoonful four times a day for a child of two years.

## HYOSCINÆ HYDROBROMIDUM, U. S. P.

(Hyoscin Hydrobromid.)

Hyoscin (see p. 83) is a useful somnifacient when sleeplessness is attended by great mental and motor excitement. Thus

it often acts favorably in *mania*, *melancholia agita* *tremens*, and *chorea insaniens*. In chronic heart di it is sometimes efficacious, it is not so generally us phin. The dose is from $\frac{1}{150}$–$\frac{1}{75}$ gr. (0.0004–0.000

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## GENERAL ANESTHETICS.

General anesthetics are volatile drugs which wh by the lungs induce unconsciousness and insensibi are employed to abolish or lessen pain and to r They are used for both of these purposes in sur tions, in labor, and in biliary and renal colic. service in subduing the convulsive seizures of teta nin-poisoning, and uremia. By suspending muscu ity they also render valuable aid in the reduction o fractures, and strangulated hernias, and in the rec deep-seated abdominal lesions. The most impor anesthetics are:

Ether. Nitrous oxid.
Chloroform. Ethyl bromic
Ethyl chlorid.

### ÆTHER, U. S. P.

(Ether, Ethyl Oxid, $C_4H_{10}O$.)

Ether is obtained by the action of sulphuric acid and appears as a colorless, volatile, highly inflamn having a strong characteristic odor. It is soluble chloroform, oils, and water. The official preparat about 4 per cent. of alcohol.

| PREPARATIONS. | Dos |
|---|---|
| Spiritus Ætheris, U. S. P. . . . . | 1–3 fl. dr. (3.5- |
| Spiritus Ætheris Compositus, U. S. P. . . . | ½–1 fl. dr. (2.0- |

**Physiologic Action.**—When freely inhale causes coughing, choking, and a sense of strang its irritant effect on the mucous membrane of the tract. Soon it induces flushing of the face, inje eyes, dilatation of the pupils, irregularity in breat increase in the rate and strength of the pulse. marked emotional excitement develops, characteriz ing, crying, laughing, or violent struggling. Thes gradually subside, and are followed by complete ness, muscular relaxation, moderate contraction o

abolition of the reflexes, slight cyanosis, regular but shallow breathing, a decrease in the rate and strength of the pulse, and some lowering of the body temperature. If the anesthetic be pushed still further, the face becomes pale or deeply cyanosed, the pulse grows feeble, the respirations become slow and very shallow, the sphincters relax, the pupils dilate, and finally death ensues, usually from failure of respiration.

**Circulatory System.**—The increase in the rate and strength of the pulse observed at the beginning of anesthesia is due in part to general excitement and partly to reflex stimulation of the heart from irritation of the air passages. Hypodermic injections of ether, as of alcohol, may also cause transient stimulation of the heart by inducing local irritation. The drug probably never directly stimulates the heart. In advanced anesthesia the blood-pressure falls, owing to depression of the heart and vasomotor center.

**Respiratory System.**—The irregular breathing often noted at the commencement of anesthesia is due partly to excitement and partly to irritation of the nasal mucous membrane. The failure of respiration occurring from overdoses of ether is the result of direct depression of the respiratory center, though in the majority of cases low blood-pressure in the medulla is an important contributing factor. Unless the cardiac weakness is too pronounced, respiratory failure can nearly always be overcome by artificial respiration. It should be borne in mind that the ill effects of ether on both the respiration and circulation are much more closely related to the degree of concentration in which it is administered than to the actual amount of it inhaled.

**Nervous System.**—Ether directly depresses the entire central nervous system, the cerebrum being first affected, then the spinal cord, and last of all the medulla. The sensory neurons are probably acted upon before the motor. From 5 to 6 per cent. of ether must be present in the inspired air to produce complete anesthesia in human beings.

**Pupils.**—The pupils are dilated at first as the result of excitement. During the period of anesthesia they are contracted as in sleep. Dilatation again occurs when consciousness is returning or when death is imminent from bulbar paralysis.

**Temperature.**—Etherization always lowers the body temperature and, therefore, it is important that the operating room should be well heated and the patient should be guarded against exposure. The fall of temperature is due partly to increased loss of heat from dilatation of the cutaneous vessels,

and partly to decreased production of heat from
of muscular movements.

**Blood.**—The studies of Da Costa and Kalteyer
indicate that anesthetics increase hemolysis, and
the percentage of hemoglobin. A slight polycyt
ever, is often observed at the close of anesthesia, pr
concentration of the blood.

**Local Action.**—When applied to the skin, ethe
quickly, produces intense cold, and thus benumbs
eral nerves. Local irritation, sometimes sufficie
inflammation and even vesication, may follow if t
tion is prevented. Inhaled, it causes considerable
the mucous membrane of the respiratory tract, an
to a profuse secretion of saliva and mucus. Durin
a certain amount of ether is swallowed with the
causes nausea and vomiting.

**Elimination.**—Ether leaves the body mainly b
though a small amount is excreted by the kidne
latter the drug has a decidedly irritant effect, an
considerable caution must be exercised in its empl
general anesthetic when there are evidences of ser
tis. After prolonged anesthesia the urine may
only albumin and casts but also certain bodies th
disturbed metabolism, such as glucose, acetone,
acid.

**Therapeutics.**—Ether was first employed as a
in general surgery by William T. G. Morton, at
chusetts General Hospital in 1846; since that time
in this country, the most extensively used anes
operations excepting the most trivial.

**The Administration of Ether as an An**
When administered as an anesthetic the following
should be observed: No solid food should be take
hours before the operation. If there has been nau
patient is very weak, a little brandy may be given
anesthetic. When given to a female, a third pe
always be present. Before its administration the t
be examined, and, if false, they should be rem
throat and waist should be freed from tight cloth
patient should not be exposed, as inflammation of
liable to follow when this precaution is unheeded.

The anesthetizer must guard against placing th
arms of the patient in positions likely to cause
nerve-trunks. The eyes should be covered wit
moistened gauze and the lips and nostrils anointed

latum to protect them from the irritant action of the ether. As the vapor of ether is highly inflammable, and since it is heavier than air, it is necessary when operating by gas-light to have the jet above the operator. In using the actual cautery special care is necessary to prevent ignition. No more ether should be used than is absolutely necessary to induce and maintain the desired degree of anesthesia. The anesthetizer should be continually on the lookout for any irregularities in the respiration or pulse and for changes in the facial appearance.

Ether may be administered from a towel loosely folded in the form of a cone, surrounded by stiff paper, and enclosing at its tip a small sponge, or, better, from an open inhaler made especially for the purpose. At first the inhaler should be held some distance from the nose, to accustom the patient to the irritant effects of the ether, but soon it should be brought close to the nose, so that the anesthetic may be inhaled in a more concentrated form. Regular snoring respiration, muscular relaxation, and insensibility of the conjunctivæ are the indications that the patient is prepared for the operation. Administration by the "drop method" or "open method," which is now adopted in many hospitals, has much to recommend it. It consists in pouring ether, drop by drop, slowly but continuously upon several layers of gauze (six or eight), supported by a wire-framed mask. Complete narcosis is produced in from eight to ten minutes. With this method there is much less tendency to coughing, struggling, and retching, the secretion of mucus is not nearly so profuse, and the frequency of after-sickness is notably reduced.

The quantity of ether required for an ordinary operation, lasting about an hour, is usually from 6 to 10 ounces (180–300 c.c.), more being necessary with the open method than the older one.

**Accidents During Anesthesia.**—The most common accident during etherization is failure of respiration. When this occurs after the first few inhalations, it is generally the result of a reflex *spasm of the laryngeal muscles* excited by the ether. The admixture of a little more air with the vapor will serve to relax the spasm, when respiration will be resumed. Embarrassed respiration is often due to the *accumulation of mucus in the upper air-passages or to the tongue falling back into the throat.* In the event of the former accident the head should be turned to one side, when much of the fluid will run out or will collect in the dependent cheek, from which it may be removed by means of a sponge held by forceps. In the event of the latter accident, it will be necessary to press the

lower jaw forward and to draw the tongue outward v
or the fingers. Finally, respiratory failure may resu
*direct action of the anesthetic on the respiratory cente*
such an accident occur, the method of treatment t
as follows: Withdraw the ether; lower the head
the legs; push the jaw forward and draw the tongu
and practice artificial respiration, persisting in it, if
for at least half an hour. If the pulse is also we
and strychnin should be given hypodermically, but
as its action closely resembles that of ether.

Sudden heart-failure is a much less common acci
ether than asphyxia. It calls for lowering of the
dermic injections of strychnin, caffein, and atropi
compression of the precordium, and artificial respir
last serves to remove the ether from the chest, fav
trance of fresh air, and stimulates the circulation.

**After-effects.**—The most common after-effects
and *vomiting*. The administration of oxygen with
thetic will often prevent their occurrence. The in
vinegar immediately after the withdrawal of the et
efficacious. Should the nausea persist, a hypoderm
of morphin and the administration of cracked ice
brandy, or of bismuth subnitrate with cerium
usually suffice to allay it.

*Pneumonia* is an occasional sequel. It has be
to exposure of the patient, to chilling of the lu
rapid evaporation of the anesthetic, to the irritant a
ether, to the accumulation of secretion in the b
finally, to the lowered vitality of the tissues induc
longed etherization.

**Paralysis.**—Central paralysis from hemorrhage c
is rare. Peripheral palsies are not infrequent, and
compression of nerve-trunks. The anesthetic contr
indirectly to the latter by rendering the patient oblivi

**Contraindications.**—The contraindications to
ment of ether as an anesthetic are advanced arte
acute inflammatory infections of the respiratory t
nephritis, especially when associated with car
lesions, and anemia when the hemoglobin is le
per cent. The presence of valvular disease is n
a contraindication, provided compensation is well
Diabetes, especially when well established and assc
acetonuria, should be considered a contraindication,
been shown that the anesthetic increases the a
renders the patient more liable to coma.

**Other Uses of Ether.**—Ether may be employed in the form of a spray to induce *local anesthesia* preliminary to opening small abscesses or performing paracentesis.

Administered hypodermically (15–30 min.—1.0–2.0 c.c.), it has long enjoyed a reputation as a diffusible stimulant in *collapse* resulting from poisoning, acute infections, and diseases of the heart itself.

It has been used internally as an anthelmintic against tapeworms and as a carminative in various forms of colic.

To allay its irritant effect on the fauces it is best given in capsules or in ice-water.

## CHLOROFORMUM, U. S. P.

(Chloroform, Chloroformum Purificatum, $CHCl_3$.)

Chloroform is a heavy, colorless, non-inflammable liquid, obtained by the action of chlorin on alcohol. It is soluble in two hundred times its volume of water, and in all proportions in alcohol, oils, and ether. The dose is 5–30 min. (0.3–2.0 c.c.).

| PREPARATIONS. | DOSE. |
|---|---|
| Aqua Chloroformi, U. S. P. . . . . | ½–1 fl. oz. (15.0–30.0 c.c.). |
| Emulsum Chloroformi, U. S. P. (4 parts of chloroform in 100) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Linimentum Chloroformi, U. S. P., Spiritus Chloroformi, U. S. P. . . . . | 20–60 min. (1.0–4.0 c.c.). |

**Physiologic Action.**—Chloroform has much the same action as ether. Like the latter, it produces, when freely inhaled, a set of phenomena which may be divided into three stages: The *first stage* is characterized by excitement, reflex effects (coughing, salivation, etc.), mydriasis, irregular breathing, acceleration of the pulse, loss of self-control, muscular rigidity, and imperfect consciousness; the *second*, by complete unconsciousness, muscular relaxation, loss of reflexes, moderate contraction of the pupils, regular shallow breathing, fall of blood-pressure, and fall of temperature; and the *third*, by symptoms of cardiac and bulbar paralysis—pallor, dilatation of the pupils, feeble irregular breathing, extreme weakness of the pulse, and very low temperature.

**Circulatory System.**—Anesthesia induced by chloroform is always accompanied by a distinct lowering of the blood-pressure. This effect is mainly due to depression of the heart muscle, but partly also to dilatation of the blood-vessels from depression of the vasomotor center. Death from chloroform may occur at the very beginning of the anesthesia from in-

tense reflex stimulation of the inhibitory cardiac c
no doubt, by the weakening effect of the drug o
muscle itself. Such sudden arrest of the organ is
to occur when the vapor is administered in too c
form.

**Respiratory System.**—In large amounts chloro
a respiratory paralyzant. It depresses the respir
not only directly but also indirectly by lowering
pressure in the medulla.

**Nervous System.**—The action of chloroform o
nervous system is marked by a progressive paraly
successively the cerebrum, the spinal cord, and t
As in the case of ether, the sensory neurons a
affected before the motor. To produce complete a
inspired air must contain not less than 1.5 to 2
cent. of the vapor.

**Temperature.**—In prolonged anesthesia there i
nounced fall in the body temperature, due in part
loss of heat from dilatation of the cutaneous vessel
to decreased production of heat from the absence
movements.

**Nutrition.**—Prolonged chloroform administrati
the output of nitrogen, phosphates, and sulphates
and produces fatty degeneration of the various orga
of the liver, heart, and kidneys. Degenerative ch
cardiac ganglia have also been described.

**Alimentary Canal.**—Taken internally in sma
chloroform produces a sense of warmth in the
creases peristaltic movements, and aids in the expul

**Local Action.**—When applied to the skin, i
rapidly and produces a sense of coldness. When
is prevented, it causes redness of the surface and ev

**Lower Organisms.**—Even in dilute solution c
destructive to many of the lower forms of animal a
life.

**Cause of Death Under Chloroform.**—Wh
is administered in too concentrated form death ma
denly at the very beginning of the anesthesia from
of the heart. Even with comparatively dilute vapo
occur late in the anesthesia from failure of the he
of the respiration, largely aided by the marked f
pressure. Again, death may occur in from twel
three or four days after the operation (delayed
poisoning) from a toxemia induced by degenerativ
the liver. In some of these cases the symptom

semble those of acute yellow atrophy of the liver, and in others the condition appears to be one of acidemia, with acetonuria, vomiting, restlessness, delirium, Cheyne-Stokes breathing, and coma as its chief manifestations.

**The Actions of Chloroform and Ether Compared.**—Chloroform is a much more powerful anesthetic than ether. Quantity for quantity, it is more irritating than ether, but being administered in less concentrated form than the latter, it is more agreeable to the patient and is less productive of coughing and choking. The toxic effect of chloroform on the circulation is much greater than that of ether, and the margin of safety between the amount required to induce anesthesia and that which causes death is much narrower with chloroform than with ether. Sudden death from intense vagal stimulation, which is not very rare under chloroform, is never observed under ether. Unpleasant sequelæ (nausea, vomiting, hypersecretion of saliva and bronchial mucus) are more pronounced after ether than chloroform anesthesia; on the other hand, serious metabolic changes (fatty degeneration of the liver, heart, etc.) are far more likely to result from the administration of chloroform than of ether. Finally, the mortality from chloroformization appears to be at least three times that from etherization.

**Therapeutics.**—Chloroform is employed as a general anesthetic, as a nerve sedative, a carminative, an anthelmintic, and a counterirritant.

**General Anesthetic.**—The precautions to be observed in administering chloroform as an anesthetic are much the same as those already described in dealing with ether. The vapor, however, must never be concentrated, but well mixed with air. A number of special devices for regulating the strength of the vapor have been recommended, but it is doubtful whether any of these offers any great advantage over the ordinary mask or folded towel in the hands of a skilled anesthetist. If the mask or towel be employed it should not be brought closer to the face than two inches, even after the patient has become accustomed to the anesthetic. If struggling occurs or the breath be held the distance should be increased, as the following inspirations will of necessity be unusually deep. The drug is best delivered drop by drop, at a rate never exceeding 60 drops per minute. Regular snoring breathing, muscular relaxation, and loss of the eye reflexes indicate complete anesthesia. An ordinary operation will not usually require more than an ounce or two of chloroform. The anesthetist should not rely upon any one sign as a warning of danger, but should keep careful watch

on the face, the respiration, and the pulse. Livi face, irregular gasping respiration, feebleness of t sudden pupillary dilatation (unless accompanied b returning consciousness) call for immediate withdr anesthetic, lowering of the head, practice of artifi tion, and the hypodermic administration of cardiac such as ammonia, strychnin, caffein, and digitalis, tion of adrenalin (1–2 c.c. of 1 : 1000 solution) in s into an artery (radial), toward the heart (Crile). the heart through the diaphragm, when operat abdomen, has also been recommended. In sudd the heart from excessive inhibition at the beginni thesia, the injection of atropin in large dose should among the restorative measures.

When chloroform is administered in the presenc gas-jets, the room should be well ventilated, sinc vapor of the anesthetic yields irritant products (es bonyl chloride) capable of inducing pneumonia w in concentrated form.

**Conditions Favoring the Use of Chlorofo Anesthetic.**—While chloroform is ordinarily mor than ether, it is to be preferred to the latter when is suffering from an acute inflammation of the resp or advanced nephritis; when it is desired merely t excitability of the nervous system, as in checking or to dull intense pain, as in labor or biliary colic; complete muscular relaxation is required, as in th of certain luxations; and when the actual caute applied.

In very hot climates chloroform is generally ether, because the latter is so very volatile that t culty in maintaining complete anesthesia with it. practice also chloroform is preferable on account of of its action and the small quantity required to ir sibility.

**Contraindications to Chloroform Anesthesi** form is particularly to be avoided in all conditi weakness; in all operations likely to be attended hemorrhage; in operations requiring the sitting p in very prolonged operations.

**Nerve-sedative.**—A few whiffs of chlorofor employed to allay motor excitation in *puerpera tetanus*, and *chorea insaniens*, and to allay loca *asthma*, *whooping-cough*, aud severe attacks of *biliary colic*.

In attacks of *angina pectoris* of great intensity Balfour and Osler recommend inhalations of chloroform. It may be dropped upon a handkerchief, or, as Balfour recommends, poured on a sponge in a smelling-bottle, and the patient told to breathe it through the nose as deeply as possible. In a minute or two relief is obtained.

In the obstinate cough of *phthisis* the addition of chloroform to the usual cough-mixture is often advantageous.

℞ Codeinæ sulphatis, gr. iv. (0.26 gm.);
Acidi hydrocyanici diluti, ♏ xl (2.5 c.c.);
Spiritus chloroformi, ʒij (8.0 c.c.);
Glycerini, ʒss (15.0 c.c.);
Elixiris aurantii, q. s. ad ʒiij (90.0 c.c.).—M.
Dose. One teaspoonful.

**Carminative.**—It is a useful carminative and sedative in *gastralgia* and *intestinal colic*. The following combination will be found useful in gastralgia:

℞ Chloroformi, ʒiss–ij (5.5–8.0 c.c.);
Spiritus ammoniæ aromatici,
Spiritus vini gallici,
Tincturæ cardamomi compositæ, āā ʒv (18.0 c.c.).—M.
Sig. A teaspoonful in hot water every fifteen or thirty minutes until relief is obtained.

**Anthelmintic.**—It has been used in large doses (ʒss–j—2.0–4.0 c.c.) as an anthelmintic against *tapeworms*, but it is an unreliable remedy. In nineteen cases reported by Whyte and Leichtenstern it proved successful in only two instances.

**Counterirritant.**—In the form of a liniment chloroform is extensively used as a stimulating application in *muscular rheumatism*, *sprains*, and *contusions*.

## NITROUS OXID.

(Nitrogen Monoxid, $N_2O$.)

Nitrous oxid is obtained from the distillation of ammonium nitrate, and appears as a colorless, odorless gas having a somewhat sweetish taste. By pressure it is converted into a liquid, and in this form is stored in iron cylinders for subsequent use.

**Physiologic Action.**—When freely inhaled, undiluted nitrous oxid causes an increase of blood-pressure, a sense of exhilaration, ringing in the ears, and lividity of the face; in a minute or two these symptoms are followed by complete unconsciousness. Upon the withdrawal of the anesthetic recov-

ery ensues in from thirty to sixty seconds. Great
laughter, or a disposition to fight is frequently
inhalation of the gas when the supply of air is not
cut off.

Nitrous oxid anesthesia, as ordinarily induced, i
part by the specific action of the gas on the cereb
part by the asphyxia resulting from the exclusion
from the lungs. According to the researches of
Kemp, the gas has no direct action on the heart o
center, the increased blood-pressure being due t
Nitrous oxid is the safest of the general anest
moreover, its use is not followed by any unple
effects. Hewitt was able to find records of bu
deaths from its administration between the year
1900.

**Therapeutics.**—As an anesthetic, nitrous oxid
suitable for *minor operations* requiring but a sho
unconsciousness. By diluting the gas with suffici
(20 per cent.) to prevent asphyxia, and administeri
ture under a pressure of one and one-quarter atm
secure free absorption, narcosis can be induced in
two, and maintained almost indefinitely. Anesth
in this way has frequently been employed in opera
from thirty minutes to an hour. The disadvantag
oxid for lengthy operations are the cumbersom
required for its administration and the large qua
needed (200 gallons per hour) for maintaining th

## ÆTHYLIS BROMIDUM.

(Ethyl Bromid; Hydrobromic Ether, $C_2H_5Br$.)

Ethyl bromid is obtained by the distillation of
ethyl alcohol, sulphuric acid, and potassium bro
perfectly pure it forms a colorless, highly volatile,
liquid having a sweetish taste and a chloroformi
exposure to air it liberates bromin and hydrobro
becomes unfit for use. It should be kept in
colored, well-stoppered bottles. It must not be
with the poisonous *ethylene bromid.*

**Physiologic Action and Therapeutics.**—
somewhat resembles chloroform in its anesthet
but it acts more quickly, is inhaled with even less
less depressing, and its effects are less lasting.
depress the respiration and lower arterial pressur
administration there is a garlicky odor on the

may persist for a day or two. With this exception it rarely causes disagreeable after-effects, such as headache, nausea, and vomiting Although its use is not entirely devoid of danger, there is good reason for believing that with a pure preparation, cautiously administered, the risk is very little greater than with ether. While not quite so safe as nitrous oxid, it has the advantage of not requiring cumbersome apparatus for its administration.

Ethyl bromid is a useful anesthetic for *short operations.* The dose for a child is from 1–3 drams (4–11 c.c.), and for an adult, from 2–6 drams (8–22 c.c.). The patient should be instructed to breathe deeply; the full dose should be poured at once upon the inhaler (preferably a towel folded into an air-tight cone), and the inhaler should be held firmly over the nose and mouth, and not removed until the anesthesia is complete. Anesthetization is usually accomplished within from thirty to forty seconds, and lasts from two to three minutes. It is not safe to continue the administration for more than two minutes, and under no circumstances should the anesthesia be prolonged by removing the mask and adding more of the drug.

The contraindications are severe lesions of the heart, lungs, or kidneys.

## ÆTHYLIS CHLORIDUM, U. S. P.

(Ethyl Chlorid, $C_2H_5Cl$.)

Ethyl chlorid is prepared by the action of hydrochloric acid gas upon absolute ethyl alcohol, the hydroxl group in the latter being replaced by chlorin. It is a colorless, highly volatile liquid, having an odor resembling that of chloroform and a burning taste. As its vapor is very inflammable, it should not be used in proximity to a gas-flame or fire.

**Physiologic Action and Therapeutics.**—Ethyl chlorid is a fugacious general anesthetic. Accompanying the anesthesia there is a fall of arterial pressure and a decrease in the pulse-rate, due probably to direct cardiac action. The vapor should be administered well mixed with air, preferably from a special apparatus, such as that devised by Apperson. The inhaler is fitted to the face in the usual way and the patient is instructed to breathe naturally. Anesthesia, as a rule, is accomplished in from one to three minutes, from 1 to 2 fluid-drachms (4.0–8.0 c.c.) of the drug being required for the purpose. Recovery is usually complete in from two to five minutes.

As a general anesthetic, ethyl chlorid is only suited for *brief*

*surgical operations.* Its action is rapid, is not atten
tation of the respiratory mucous membrane, chol
tion, or cyanosis, and is rarely followed by nausea c
complete muscular relaxation, however, is not ol
has an advantage over nitrous oxid in not requiri
some apparatus for its administration and in p
longer narcosis, and over ethyl bromid in not leavi
sive garlicky odor on the breath. The relative saf
chlorid remains to be determined. Quite a num
accidents from its use, however, have already bee
The future will probably accord it a place below tha
form.

On account of the intense cold caused by its rap
tion, ethyl chlorid is frequently employed as a *loca*
in *minor operations.*

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## GENERAL ANALGESICS OR ANO

General analgesics or anodynes are remedies w
pain without necessarily inducing unconsciousnes
anesthesia. They accomplish their object by dep
sensory side of the central nervous system. The
ful analgesic is *opium.* While it has the power
pain arising from almost any cause, it is especia
pain occasioned by gross lesions—inflammation,
and morbid growths. In the various so-called func
such as headache and neuralgia, the coal-tar deriv
*pyrin*, *phenacetin*, and *acetanilid*—are more servi
gesics. The manner of their action is not defin
but they probably act upon the perceptive centers
*Cannabis indica* somewhat resembles opium in its
analgesic, but it is far less powerful. It is especia
neuralgia and migraine. The *bromids*, by depress
bral cortex, often afford relief in headache, but in
of pain they usually fail. Some drugs seem to ha
for certain nerves: thus, *gelsemium* and *butyl ch*
are often distinctly valuable in trifacial neuralgia.

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## ANTICONVULSANTS.

Certain drugs have the power of controlling c
vulsions by directly diminishing the excitability
area in the cortex of the brain. A drug that th
the motor centers, and also lessens the power

side of the spinal cord to convey discharges from the brain to the muscles, or lessens the power of the sensory side of the spinal cord to transmit to the brain stimuli from without, has additional value as an anticonvulsant.

*Anesthetics* (ether and chloroform) profoundly affect the brain and spinal cord, first depressing the sensory parts and then the motor. They are especially useful in severe convulsions, such as may occur in hysteria, puerperal eclampsia, and the status epilepticus. *Bromids* also depress the brain and the spinal cord. While their action is not so powerful as that of the anesthetics, it is much more permanent. They are very useful in epilepsy and in the reflex convulsions of childhood. *Chloral* appears to have more influence on motor activity than the bromids, and is especially useful in convulsions of spinal origin, such as those of strychnin-poisoning and tetanus, although it may be employed with advantage also in uremic, infantile, and puerperal convulsions. It is too depressing for continuous use in essential epilepsy. *Antipyrin* and *Solanum Carolinense* (horse-nettle) are of some value in essential epilepsy, but the manner in which they act is not definitely known. *Amyl nitrite* is of service in aborting threatened convulsions and in breaking up a series of seizures, such as occur in the status epilepticus. Its efficacy has been ascribed by some authorities to direct depression of the central nervous system, and by others to dilatation of the arterioles of the brain.

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## ANTISPASMODICS.

Antispasmodics are remedies used to control minor grades of motor excitation and to lessen states of general nervous irritability. They vary in the manner of their action. Some, like hops and lactucarium, are feeble depressants of the nervous system, while others, like asafetida and valerian, probably owe what virtue they possess to the mental effect induced by their strong odor and taste. As a class, antispasmodics are useful in hysteria, nervous excitability, and local spasms. The following drugs are the most important members of this group:

| | |
|---|---|
| Camphor. | Cimicifuga. |
| Asafetida. | Lactucarium. |
| Valerian. | Hops. |
| Compound spirit of ether. | Sumbul. |
| Musk. | Viburnum prunifolium. |

Oil of amber.

## CAMPHORA, U. S. P.

(Camphor, $C_{10}H_{16}O$.)

Camphor is a whitish, translucent, volatile substance (solid volatile oil or stearopten), having a penetrating odor and a pungent taste, and obtained by distilling the wood of an Oriental tree—*Cinnamomum Camphora.* It dissolves freely in all ordinary menstrua except water, in which it is only sparingly soluble. The dose is from 1–5 gr. (0.06–0.3 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Aqua Camphoræ, U. S. P. (0.8 per cent.) | ½–1 fl. oz. (15.0–30.0 c.c.). |
| Ceratum Camphoræ, U. S. P. (10 per cent.). | |
| Linimentum Camphoræ, U. S. P. (20 per cent. in cotton-seed oil). | |
| Linimentum Saponis, U. S. P. (4.5 per cent.). | |
| Spiritus Camphoræ, U. S. P. (10 per cent.) | 10–30 min. (0.6–2.0 c.c.). |

It also enters into *Tinctura opii camphorata.*

**Physiologic Action.**—In therapeutic doses camphor stimulates the higher cerebral centers, exerting a calmative influence in the presence of nervous irritability. It has a stimulating effect on the heart, although after large doses the blood-pressure falls, probably from paresis of the vasomotor center. In the stomach it acts as a mild carminative, inducing a sensation of warmth, increasing peristalsis, and expelling flatus. The action of camphor on the respiration has not been fully determined, but the researches of Stockman and Binz indicate that the drug is a stimulant to the respiratory center. Moderate doses exert a feeble anaphrodisiac effect. Applied externally it acts as a stimulant and antipruritic. When taken internally much of it is destroyed in the body, but a part is eliminated in the urine as camphoglycuric acid.

Toxic doses of camphor produce languor, vertigo, headache, confusion of thought, tinnitus aurium, gastric irritation, a rapid, feeble pulse, convulsions, and collapse. The convulsions are of an epileptiform character, and are due to the action of the drug on the cerebral cortex.

**Therapeutics.**—Camphor is employed as an antispasmodic, a circulatory stimulant, carminative, and rubefacient.

As an antispasmodic, it has been recommended in *hysterical excitement, hiccough, dysmenorrhea, whooping-cough, chordee,* and the various *climacteric neuroses.*

As a circulatory stimulant, camphor is exceedingly valuable in *adynamic fevers,* particularly in typhoid fever and pneumonia. It not only serves to strengthen the pulse in these affections, but it also acts favorably in lessening the restlessness and delirium.

side of the spinal cord to convey discharges from the brain to the muscles, or lessens the power of the sensory side of the spinal cord to transmit to the brain stimuli from without, has additional value as an anticonvulsant.

*Anesthetics* (ether and chloroform) profoundly affect the brain and spinal cord, first depressing the sensory parts and then the motor. They are especially useful in severe convulsions, such as may occur in hysteria, puerperal eclampsia, and the status epilepticus. *Bromids* also depress the brain and the spinal cord. While their action is not so powerful as that of the anesthetics, it is much more permanent. They are very useful in epilepsy and in the reflex convulsions of childhood. *Chloral* appears to have more influence on motor activity than the bromids, and is especially useful in convulsions of spinal origin, such as those of strychnin-poisoning and tetanus, although it may be employed with advantage also in uremic, infantile, and puerperal convulsions. It is too depressing for continuous use in essential epilepsy. *Antipyrin* and *Solanum Carolinense* (horse-nettle) are of some value in essential epilepsy, but the manner in which they act is not definitely known. *Amyl nitrite* is of service in aborting threatened convulsions and in breaking up a series of seizures, such as occur in the status epilepticus. Its efficacy has been ascribed by some authorities to direct depression of the central nervous system, and by others to dilatation of the arterioles of the brain.

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| Asafetida. | Lactucarium. |
| Valerian. | Hops. |
| Compound spirit of ether. | Sumbul. |
| Musk. | Viburnum prunifolium. |

Oil of amber.

**Therapeutics.**—Monobromated camphor is em
an antispasmodic and anaphrodisiac. It has bee
mended in *hysteria*, *delirium tremens*, *chorea*, and
*cough*, but its use in these affections is only rarel
with success. In *petit mal* it is sometimes more effe
the ordinary bromids. Its more important use
anaphrodisiac. It often proves very efficacious in
*sexual excitement*, *chordee*, *spermatorrhea*, etc. Its c
back is its tendency to induce heartburn and eructa
spermatorrhea it may be combined with hyoscin, as
lowing formula:

℞ Hyoscinæ hydrobromidi, gr. $\frac{1}{10}$ (0.006 gm.);
Camphoræ monobromatæ, ʒj (4.0 gm.).—M.
Fiant pilulæ No. xx.
Sig. One or two at bedtime.

## ASAFŒTIDA, U. S. P.

(Asafetida.)

Asafetida is a gum-resin obtained by incising th
*Ferula fœtida*, an umbelliferous plant abounding
and Afghanistan. It appears in the form of irregul
or tears of a yellowish-brown color, and has a
garlicky odor and an acrid taste. It consists of
and an essential oil (about 4 per cent.) which is rich
The oil is the most active ingredient. The dose is
gr. (0.2–0.65 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Emulsum Asafœtidæ, U. S. P. (4 per cent. watery emulsion) | ½–1 fl. oz. (15.0– |
| Tinctura Asafœtidæ, U. S. P. | ½–1 fl. dr. (2.0–4 |
| Pilulæ Asafœtidæ, U. S. P. (3 gr.—0.2 gm.) | 1–3 pills. |

**Physiologic Action.**—On the circulatory an
systems asafetida acts as a feeble stimulant; on the
canal, as a carminative.

**Therapeutics.**—Asafetida is employed chiefly
spasmodic and as a carminative. As an antispas
used in *nervous excitement*, *whooping-cough*, and *hyst*
positories of asafetida are sometimes valuable in *in*
*vulsions* and in the *restlessness of the specific fev*
carminative, it is an excellent remedy in *infantile co*
*flatulent dyspepsia of the aged*. An enema of asafe
of the most efficacious remedies that we possess
*tympanites*. Asafetida has also been employed as a
expectorant in *chronic bronchitis*.

**Administration.**—For continued use the drug is best administered in the form of pills. To children it may be conveniently administered in the form of suppositories. In tympanites the official emulsion (4–6 ounces—120.0–175.0 c.c.) should be employed as an enema.

## VALERIANA, U. S. P.

(Valerian.)

Valerian is the rhizome and roots of *Valeriana officinalis*, a native of Europe. Its active principles are a volatile oil and valeric acid.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Valerianæ, U. S. P. . . . . | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Tinctura Valerianæ Ammoniata, U. S. P. (made by macerating valerian in aromatic spirits of ammonia) . . . . . | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Fluidextractum Valerianæ, U. S. P. . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |

**Physiologic Action.**—In moderate doses valerian has a slight stimulant effect on the central nervous system, especially the cerebrum, and on the circulation. Very large doses produce a sense of warmth in the stomach, quickening of the pulse, vomiting, diarrhea, frequent micturition, headache, vertigo, and hallucinations.

**Therapeutics.**—Valerian is a valuable remedy for subduing the various nervous phenomena occurring in patients of excitable temperaments. The *spasms*, *headache*, *palpitation*, *globus*, *sleeplessness*, and *flatulent distention of hysteria* are often remarkably influenced by the drug.

### AMMONII VALERAS, U. S. P.

(Ammonium Valerate; Ammonium Valerianate, $NH_4C_5H_9O_2$.)

Valerate of ammonia occurs in the form of colorless quadrangular plates having the odor of valeric acid and a sharp, sweetish taste. It is freely soluble in water and alcohol. Its dose is from 5–10 gr. (0.3–0.6 gm.) in the form of an elixir.

It is employed for the same purposes as valerian.

### FERRI VALERAS.

(Iron Valerate; Iron Valerianate, $Fe_2(C_5H_9O_2)_6$.)

Iron valerate appears as a dark-red amorphous powder, having the odor of valeric acid. It is a useful combination of an antispasmodic with a chalybeate, and may be prescribed with advantage in *anemia*, associated with *nervous excitement*

or *hysteria*. The dose is from 1–3 gr. (0.06–0.2 g form. The following tonic and antispasmodic pil valerates is frequently prescribed:

℞ Ferri valeratis,
Zinci valeratis,
Quininæ valeratis, āā gr. xx (1.3 gm.).—M.
Fiant pilulæ No. xx.
Sig. One after meals.

### ZINCI VALERAS, U. S. P.

(Zinc Valerate; Zinc Valerianate, $Zn(C_5H_9O_2)_2 + H_2O$.

Zinc valerate appears in the form of white, pea having the odor of valeric acid, and a sweetish, and metallic taste. It is soluble in 100 parts of wa parts of alcohol. The dose is from ½–3 gr. (0.03–0. It has about the same therapeutic value as valeria

### SPIRITUS ÆTHERIS COMPOSITUS, U

(Compound Spirit of Ether; Hoffmann's Anodyne.)

Hoffmann's anodyne is a colorless, inflammable li ing an ethereal odor and taste. It consists of 325 volume of ether, 650 parts of alcohol, and 25 parts oil, the last being an ethereal solution of the product tillation of sulphuric acid and alcohol. The dose is fl. dr. (2.0–8.0 c.c.).

**Physiologic Action and Therapeutics.**—H cludes, from a careful study of this compound, that tive effects are largely due to the ether which it rather than to the ethereal oil, and that each of its i stimulates the system—the ether the most, and th oil the least powerfully.

Hoffmann's anodyne is an excellent carminativ pelling gas from the stomach. It affords pron in severe *paroxysmal palpitation* dependent upo flatulence. It is often of service in *angina pectoris*, when the attacks are precipitated by flatulency. *valvular disease*, when compensation is partially los patient suffers from restlessness, dyspnea, and insc compound spirit of ether often acts most favorab sometimes very efficacious in *hiccough*. A combin the following will be found useful in *asthma*:

℞ Ammonii bromidi, ℥ij (8.0 gm.);
Tincturæ belladonnæ, f℥j (4.0 c.c.);
Tincturæ lobeliæ, f℥ij (8.0 c.c.);
Spiritus ætheris compositi, f℥j (30.0 c.c.);
Elixiris aromatici, q. s. ad f℥iij (90.0 c.c.)
Sig. A dessertspoonful in water every hour or two during the pa

The following mixture is often serviceable in severe gastric flatulency:

℞ Spiritus ætheris compositi,
Spiritus camphoræ, aa ʒss (2.0 c.c.);
Spiritus menthæ piperitæ, ♏vj (0.4 c.c.).—M.
Sig. To be taken in water.

## MOSCHUS, U. S. P.

(Musk.)

Musk is the dried secretion from the preputial follicles of *Moschus moschiferus*, a species of deer found in Central Asia. It appears as reddish-black unctuous grains having a peculiar penetrating odor and a bitter aromatic taste. The dose is from 5–15 gr. (0.3–1.0 gm.), given preferably by the rectum, in suppository or suspended in mucilage.

| Preparation. | Dose. |
|---|---|
| Tinctura Moschi, U. S. P. (5 per cent.) | 1–2 fl. dr. (4.0–8.0 c.c.). |

**Therapeutics.**—Musk is used as an antispasmodic and as a general stimulant. As Graves first pointed out, it is a most valuable stimulant in *typhoid fever* and *kindred affections*, when there are profound nervous exhaustion and circulatory failure. It is also of service in *obstinate hiccough*, the *convulsions of childhood*, and *laryngismus stridulus*. The great drawbacks to its use are its costliness and the difficulty in obtaining an unadulterated preparation.

## CIMICIFUGA, U. S. P.

(Black Snakeroot, Actæa Racemosa.)

Cimicifuga is the dried rhizome and rootlets of *Cimicifuga racemosa*, a perennial plant growing in the woodlands of North America. It contains a resin, a bitter neutral substance, and a volatile oil.

| Preparations. | Dose. |
|---|---|
| Tinctura Cimicifugæ, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Cimicifugæ, U. S. P. | 10–30 min. (0.6–2.0 c.c.). |
| Extractum Cimicifugæ, U. S. P. | 2–8 gr. (0.1–0.5 gm.). |

**Physiologic Action.**—In large doses cimicifuga causes nausea, headache, vertigo, tremors, muscular relaxation, slowing and weakening of the pulse, anesthesia, and, finally, paralysis of respiration. The anesthesia is due, according to Hutchinson, to paralysis of the sensory side of the spinal cord. The weakness of the pulse is probably due to a direct depressant effect exerted on the heart itself. In full doses it seems also to possess the power of stimulating uterine contractions.

**Therapeutics.**—Cimicifuga is a valuable remedy in *simple*

*chorea*, ranking next to arsenic in efficiency. It shou
in doses of 10 min. (0.6 c.c.) of the fluid extract th
day, after meals, and gradually increased to from ½-
4.0 c.c.). It is sometimes of service in chronic
affections of the nerves and muscles, like *myalgia*, *
*sciatica*, and *lumbago*, but in articular rheumatism i
value. It is said to be useful in *atonic amenorr*
*rhagia*, and *sudden cessation of the menses* from cold
shock. It has been used in labor to stimulate u
tractions, its action resembling that of quinin rath
of ergot. Ringer strongly recommends it in c
with gelsemium for the distressing symptoms att
menopause; and, according to Simpson, it is highl
in the *mental disturbances* which sometimes follow
It is often of distinct service in relieving the *tinn*
accompanying chronic catarrh of the middle ear.
used as an expectorant in *bronchitis*, with free ex
and in *phthisis*.

## LACTUCARIUM, U. S. P.

(Wild Lettuce.)

Lactucarium is the concrete milk-juice of *Lac*
a biennial herb cultivated chiefly in Central an
Europe. It contains lactucin (a bitter principle), l
lactucopicrin, and lactucerin. The dose is from ½
4.0 gm.).

| Preparations. | Dose. |
|---|---|
| Tinctura Lactucarii, U. S. P. . . . . | ½–1 fl. dr. (2.0– |
| Syrupus Lactucarii, U. S. P. . . . . | 1–4 fl. dr. (4.0– |
| Fluidextractum Lactucarii . . . . . | 20–30 min. (1.2 |

**Therapeutics.**—Lactucarium is a feeble hypn
dyne, and an antispasmodic. Added to cough-m
syrup is a useful sedative in the *acute bronchitis* of

## HUMULUS, U. S. P.

(Hops.)

Hops are the dried strobiles of *Humulus Lupulu*
climber largely cultivated in Europe and the U
They have an aromatic odor, and a bitter, slight
taste. A glandular powder separated from the d
is also official as *Lupulinum* (lupulin). Lupulin, o
contain from 8 to 15 per cent., appears in the for

yellowish-brown, resinous granules, having a bitter aromatic taste. The chief constituents of hops are cholin (a volatile, liquid alkaloid), a volatile oil, lupamaric acid (the bitter principle), tannic acid, and a resin. The dose of lupulin is from 5–15 gr. (0.3–1.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Humuli, | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Lupulini, U. S. P. | 5–30 min. (0.3–2.0 c.c.). |
| Oleoresina Lupulini, U. S. P. | 2–5 gr. (0.13–0.3 gm.). |

**Therapeutics.**—Hops act as a bitter tonic and as a feeble hypnotic. In the *restlessness of fevers* and in *delirium tremens* they are sometimes useful sedatives. They have been found especially serviceable in *chordee*, *spermatorrhea*, and *vesical irritation*. The following suppositories, containing lupulin, afford relief in chordee:

℞ Pulveris opii, gr. vj (0.4 gm.);
Pulveris camphoræ, gr. xxiv (1.5 gm.);
Lupulini, ʒj (4.0 gm.);
Olei theobromatis, q. s.—M.
Fiant suppositoria No. vi.
Sig. Introduce one into the bowel at bedtime.

## SUMBUL, U. S. P.

(Musk-root.)

Sumbul is the root of *Ferula Sumbul*, a perennial herb growing in Central Asia. Its chief constituents are a resin, to which its musk-like odor is due, a fixed oil, angelic acid (sumbulic acid), and valerianic acid. The dose of the root is from 10–30 gr. (0.6–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Sumbul, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Extractum Sumbul, U. S. P. | 2–5 gr. (0.1–0.3 gm.). |

**Therapeutics.**—Sumbul is sometimes useful as an antispasmodic in *hysteria* and allied neuroses. In *neurasthenia* the extract may be given in pill with iron and arsenic. The following combination, suggested by Bradbury, is very effective in relieving the insomnia, mental depression, and flushing heats commonly occurring at the *menopause*:

℞ Ammonii bromidi, ʒij (8.0 gm.);
Fluidextracti sumbul,
Tincturæ humuli, āā fʒiss (45.0 c.c.);
Spiritus camphoræ, fʒiij (11.0 c.c.);
Elixiris aromatici, q. s. ad fʒvj (175.0 c.c.).—M.
Sig. Tablespoonful in water after meals.

## VIBURNUM PRUNIFOLIUM, U. S

(Black Haw.)

Officially viburnum prunifolium is the bark of a of the same name, growing in the eastern and sout of North America. Its chief constituents are vibur principle), valerianic acid, resin, and tannin.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Viburni Prunifolii, U. S. P. . . | ½–2 fl. dr. (2. |

**Therapeutics.**—Large doses of the fluid extr to cause in warm-blooded animals drowsiness, a fa pressure, muscular relaxation, and a diminution of tability. It is employed chiefly as a uterine and o tive. It has been found useful in *habitual abortio* in non-syphilitic patients. Combined with opiun efficacious in *threatened abortion*. In *non-inflam menorrhea* it affords great relief when given in dr. (4.0 c.c.) three times a day, beginning five or six menstruation. It is sometimes very successful i the *menstrual irregularities* and *nervous distres* about the time of the menopause.

## OLEUM SUCCINI.

(Oil of Amber.)

Oil of amber is a volatile oil obtained by the des tillation of a fossil resin which is yielded by su trees washed ashore along the coast of Prussia. transparent, yellow liquid, having a balsamic odor acrid taste. The dose is from 5–10 min. (0.3–0.6 sules or in an emulsion.

**Therapeutics.**—Oil of amber, with camphor tine, was at one time held in high repute as a liniment for the chest in *whooping-cough* and *acu* Internally it is sometimes efficacious in *obstinate h*

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# SPINAL CORD EXCITANTS

Spinal cord excitants, or excitomotors, are d increase the functional activity of the spinal cord. lating the cell-bodies of the lower motor neurons gerate reflex activity, and if given in toxic dose, in convulsions. The origin of the convulsions excite can be determined in animals by dividing the

between the occiput and the atlas. Convulsions of cerebral origin cease after section, while those of spinal origin do not. The most important spinal cord excitants are:

| | |
|---|---|
| Strychnin. | Caffein. |
| Brucin. | Ammonium salts. |
| Hydrastin. | Phenol. |

With the exception of strychnin and brucin, however, these drugs do not sensibly excite the spinal cord unless given in toxic doses.

The indications for using excitomotors as such cannot be stated very definitely. They often prove efficacious, however, when loss of power is dependent upon depression of the motor neurons, and not upon destructive lesions. When there is evidence of inflammation they are absolutely contraindicated.

## NUX VOMICA, U. S. P.

Nux vomica is the seeds of the *Strychnos Nux vomica*, a small tree growing in the East Indies. It contains two alkaloids, *strychnin* and *brucin*. Strychnin fully represents the action of the crude drug. It is official as *Strychnina*, which is very sparingly soluble in water, as *Strychninæ nitratis*, which is soluble in 42 parts of water, and as *Strychninæ sulphatis*, which is soluble in 31 parts of water. All these preparations appear as colorless crystals or crystalline powders, having an intensely bitter taste. Brucin resembles strychnin in its action, but is less powerful. The dose of strychnin or of either of its salts is from $\frac{1}{60}$–$\frac{1}{20}$ gr. (0.001–0.003 gm.).

| Preparations. | Dose. |
|---|---|
| Extractum Nucis Vomicæ, U. S. P. | $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.008–0.03 gm.). |
| Fluidextractum Nucis Vomicæ, U. S. P. | 1–5 min. (0.06–0.3 gm.). |
| Tinctura Nucis Vomicæ, U. S. P. | 5–20 min. (0.3–1.3 c.c.). |
| Pulvis Nucis Vomicæ, | 1–5 gr. (0.06–0.3 gm.). |

Strychnin enters into the glycerite of the phosphates of iron, quinin, and strychnin, the syrup of the phosphates of iron, quinin, and strychnin, the compound syrup of hypophosphites, and compound laxative pills.

**Physiologic Action.—Circulatory System.**—In full medicinal doses strychnin raises the blood-pressure and slightly lessens the frequency of the pulse. The first of these effects is chiefly the result of vasoconstriction induced by stimulation of the vasomotor center in the medulla, the heart being stimulated but feebly, if at all. The decreased frequency of the pulse is due to stimulation of the cardiac inhibitory center.

Toxic doses tend to lower the blood-pressure by the vasomotor center; but during the convulsive duced by the drug an enormous increase in the pr be observed as a result of the violent muscular con

**Nervous System.**—Strychnin is a powerful stim spinal cord and medulla. Upon the cerebrum it h tively little influence. Toxic doses increase reflex i the spinal cord to such an extent that the slightest st the periphery induces violent tetanic convulsions. T son to believe that this effect is not the result of direct of the motor cells in the anterior horns, but of decr ance on the sensory side of the cord, in consequen slight impulses from the periphery, instead of reac fluencing but a limited number of motor cells, as the case, are permitted to spread out and excite the of the entire cord. Thus, in frogs, convulsions do strychnin injections after division of the sensory r alysis of the sensory nerve-endings by cocain.

After a time, especially in the lower animals, th effects of strychnin are replaced by those of paraly tral nervous system and motor nerve-endings bot the depression.

**Special Senses.**—The special sense-organs als be sensitive to strychnin, for after its use vision, smell become more acute.

**Muscle.**—By increasing the sensitiveness of the to all centripetal sensory irritation, strychnin i tonus of both plain and striped muscles througho

**Respiratory System.**—The respiratory mov quickened and strengthened by strychnin, owing lant action on the medullary center.

**Alimentary Canal.**—Taken by the mouth, stryc preparations of nux vomica, like other very bitter whet the appetite, increase the secretions, and s peristaltic movements of both stomach and bowels

**Metabolism.**—By increasing muscular activit augments considerably the consumption of oxy output of carbonic acid.

**Elimination.**—Strychnin is eliminated chiefly neys. Its excretion is very slow, and, therefore, th of cumulative effects arising from the prolonged an use of the drug should be borne in mind.

**Toxicology.**—The first evidences of the tox strychnin are restlessness, anxiety, twitching and the muscles, and stiffness of the neck. If the do

sufficiently large, spinal convulsions speedily develop, throwing the patient's body into orthotonos or opisthotonos. The convulsions are, for the most part, intermittent, and are repeated under the slightest external irritation. The pupils are dilated, the vision is hyperacute, the mind is unaffected, and the stomach is usually retentive. In fatal cases the convulsions become more rapid and severe, and finally death results from asphyxia due to spasmodic fixation of the respiratory muscles or from exhaustion. In the lower animals very large quantities of the drug may kill by paralyzing the central nervous system or the motor nerve-endings. The fatal dose of strychnin for man is from ½ to 1½ grains (0.032–0.1 gm.).

The history of the case, the absence of a wound, the abrupt onset, the intermittent character of the convulsions, and the late involvement of the muscles of the jaw (trismus) will serve to distinguish strychnin-poisoning from tetanus.

The history of the case, the emotional excitement, the closed eyes, and the persistent opisthotonos will serve to distinguish hysteria from strychnin-poisoning.

**Treatment.**—Since the slightest stimulus will provoke convulsions, the patient should be disturbed as little as possible. If convulsions have already begun, no attempt should be made to use a stomach-pump until the reflex excitability has been subdued by inhalations of chloroform or amyl nitrite. Tannic acid in solution may be administered as a chemical antidote. The best physiologic antidotes are potassium bromid (ʒj–ij—4.0–8.0 gm.) and chloral (20 gr.—1.3 gm.); when the patient is unable to swallow the chloral, 1 dr. (4.0 gm.) may be given in an enema. Osterwald observed very beneficial effects from oxygen inhalations in strychnin-poisoning in animals.

**Therapeutics.**—Nux vomica or strychnin is used chiefly as a circulatory stimulant, a respiratory stimulant, an excito-motor, and a stomachic.

**As a Circulatory Stimulant.**—In *simple dilatation of the heart*, with or without valvular disease, strychnin often renders good service when combined with digitalis, but used alone it is distinctly inferior to the latter drug. In *pneumonia* and other *infective processes* it is an excellent adjuvant to alcohol and digitalis. In *the weak heart of the old* it is generally a better remedy than digitalis. It is also useful in *surgical shock*.

**As a Respiratory Stimulant.**—Being both a respiratory and a circulatory stimulant, strychnin is indicated in diseases of the lungs associated with enfeeblement of the respiration and pulse, such as *pneumonia*, *emphysema*, and some cases of

*chronic bronchitis* and *phthisis*. In emphysema no is so useful. Employed hypodermically in cases c *monary edema* it is scarcely less efficient than atro

In *poisoning* by drugs which depress the heart or center strychnin is of value. In poisoning by opi aconite, ether, or chloroform it should be given ically in full doses.

**As an Excitomotor.**—When paralysis is the re plete destruction of nerve-cells or fibers, strych other drugs, will be ineffective; but when the loss the result simply of depression or exhaustion of apparatus, it may prove useful. It is commonly p the *hemiplegia* following apoplexy, but it is valu condition except, perhaps, as a general tonic. C hand, in the various forms of *peripheral neur* plumbic, alcoholic, diphtheritic, and that due to p often of considerable service. It should not be ever, until all acute symptoms of the affection ha

In *neurasthenia* minute doses of strychnin with sometimes efficacious, but more often the drug i actually harmful. In *amaurosis* from tobacco, alc it is invaluable.

It is thought that intramuscular injections of s in restoring power to the affected muscles in *acute* This treatment, however, should not be institute or four weeks after the incidence of the disease. often affords relief in *incontinence of urine* from bladder—a condition sometimes met with in old p likewise an excellent remedy in *constipation* dep atony of the intestinal walls.

**As a Stomachic.**—Nux vomica is often ve *chronic dyspepsia* when there are no manifestatic inflammatory trouble. In these cases the chief s a coated, flabby tongue, anorexia, fulness and some time after eating, deficient secretion of hydr flatulence, and constipation. In such types of in tincture of nux vomica (5 or 10 drops before me without hydrochloric acid, often acts most happil doses it is also of service in *dilatation of the sto* atony. It is a trustworthy remedy in those case *flatulence*, common in elderly people, dependent of tone in the walls of the stomach and bowel.

Strychnin is contraindicated in gastric affection is hypersecretion of hydrochloric acid, and wh evidences of well-marked inflammation.

**Other Uses.**—In *hyperemesis* not dependent upon organic disease of the stomach, the tincture of nux vomica (1–2 drops) alone, or with wine of ipecac (½–1 drop), every hour or two, will often afford relief. Good results are sometimes obtained with strychnin as a prophylactic remedy in *uterine inertia*. It has been recommended by Murrell and Brunton to check the *night-sweats of phthisis*. It is useful in *sexual impotence* due to lowered nervous tone. Dana and others speak very favorably of strychnin in heroic doses in *tic douloureux* occurring in anemic and exhausted patients, and when the duration of the disease has not been more than one or two years. The drug is given hypodermically once a day, and the dose is gradually increased from $\frac{1}{30}$ to $\frac{1}{6}$ of a grain (0.002 to 0.013 gm.), ten to twenty days being required to reach this maximum. A number of observers (Posner, Feilchenfeld, Ketly, Spaether) speak favorably of the action of strychnin in *diabetes insipidus*.

**Administration.**—Strychnin sulphate and extract of nux vomica are suitable preparations for use in pills. When a liquid preparation is desired, as in atony or dilatation of the stomach, the tincture will be found reliable. The nitrate of strychnin is sometimes preferred to the sulphate for hypodermic use, but it has no special advantage over the latter. Nervous excitement, restlessness, and twitching of the muscles are indications that the limit of physiologic action has been reached.

**Incompatibles.**—Strychnin is incompatible with tannic acid, alkalies, chlorids, iodids, and bromids.

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## SPINAL CORD DEPRESSANTS.

Under this head are considered drugs that lessen reflex action by depressing the neurons of the spinal cord. They may act solely on the motor neurons, impairing their ability to discharge power, or they may act also on the sensory neurons and thus protect the motor neurons from the influence of peripheral irritation. The following are most important members of this group:

| | |
|---|---|
| Physostigma. | Hydrated chloral. |
| Gelsemium. | Ether. |
| Bromids. | Chloroform. |

Spinal cord depressants are useful in combating symptoms resulting from irritation of the neurons of the lower motor segment. Thus, they are of value in controlling the paroxysms

of laryngismus stridulus, the spasms of tetany, and of paralysis agitans. They are also of service in hyperexcitability of the lower motor neurons ca tain poisons, as strychnin and that of tetanus. Fi cord depressants are not without value in the t convulsive seizures which have a cerebral origin pressing the lower motor neurons they impair of transmitting excessive discharges from the l muscles, and by depressing the lower sensory n afford the brain more or less protection from th external stimuli.

## PHYSOSTIGMA, U. S. P.

(Calabar Bean.)

Physostigma is the seed of *Physostigma v* perennial climber, growing in West Africa. It alkaloids, *physostigmin* or *eserin*, and *calabarin;* less important than the former, and resembles its action.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Physostigmatis, U. S. P. . . . | 5–30 min. (0.3- |
| Extractum Physostigmatis, U. S. P . . . | $\frac{1}{8}$–$\frac{1}{4}$ gr. (0.008– |

Physostigmin, or eserin, fairly represents the acti of the bean. It occurs in yellowish-white cryst cent, odorless, bitter, sparingly soluble in water, b in alcohol and dilute acids, and turning pink The dose is from $\frac{1}{120}$–$\frac{1}{30}$ gr. (0.0005–0.002 gm.) are official:

Physostigminæ sulphas.
Physostigminæ salicylas.

The sulphate is very soluble in water, and th soluble in 72.5 parts of water. The dose of eithe $\frac{1}{100}$–$\frac{1}{30}$ gr. (0.0006–0.002 gm.).

**Physiologic Action.**—**Circulatory System.**- apeutic doses of physostigmin do not affect th Large doses decrease the pulse-rate and strengt probably by acting on the heart-muscle directly raise the blood-pressure, partly by powerfully co intestines and thus driving the blood out of th area, and partly by stimulating the muscular arterioles. Toxic doses lower the blood-pressure the vasomotor center.

**Central Nervous System.**—In large doses lessens reflex activity and induces muscular

depressing the motor neurons of the spinal cord. It also depresses the medullary centers, but it is apparently without influence on the cerebrum, for in poisoning consciousness is preserved until the end.

**Respiratory System.**—Therapeutic doses do not affect the respiration, but toxic doses kill by paralyzing the respiratory center.

**Muscles.**—Physostigma increases the irritability of both striped and unstriped muscle, and in toxic doses causes fibrillary tremors and tetanoid contractions. The latter appear to be due to stimulation of the peripheral nerve-endings, as they occur after section of the nerve-trunks, but disappear after injections of curare.

**Secretions.**—Large doses of physostigmin increase the flow of saliva, sweat, mucus, and pancreatic juice by stimulating the nerve-endings in the secretory glands. This action is offset by large doses of atropin.

**Alimentary Canal.**—Physostigmin powerfully increases the peristaltic movements of the stomach and bowel by stimulating the nerve-endings in the muscular coat of these organs, and probably also the muscular protoplasm itself.

**Eye.**—Local applications of physostigmin cause marked contraction of the pupil by stimulating the peripheral endings of the oculomotor nerve, and probably also the iris muscle itself. They also induce spasm of accommodation by acting similarly on the ciliary muscle, and decrease intraocular tension, partly by narrowing the pupil and partly by constricting the ocular vessels.

**Toxicology.**—Physostigmin-poisoning is characterized by vertigo, great muscular relaxation, tremors and twitchings of the muscles, abolition of reflex action, contraction of the pupils, slowing of the pulse, salivation, and sometimes colicky pains with nausea and vomiting.

**Treatment of Poisoning.**—This consists in evacuating the stomach by an emetic, in administering atropin as a physiologic, and tannic acid as a chemical, antidote, and in combating respiratory and cardiac failure with such stimulants as ammonia, strychnin, and alcohol.

**Therapeutics.**—Physostigma has a very limited range of usefulness; it is chiefly employed to depress the spinal cord, to contract the pupils, to lessen intra-ocular tension, and to stimulate involuntary muscles, especially those of the stomach and intestine.

It has been used to depress the spinal cord in *tetanus*, *strychnin-poisoning*, and *chorea*, but in these affections we have far more reliable remedies.

The extract sometimes makes a useful addition pills intended to relieve *constipation* dependent upo the intestinal walls. In full doses, preferably hypo it is sometimes serviceable in the *excessive tympanite fever*, and in *postoperative intestinal paresis*. Rin ommended it in *chronic bronchitis* with dyspnea, d ness of the bronchial muscles. It has found favo practitioners in the treatment of *atonic dilatation of*

**Eye-affections.**—Physostigmin sulphate is use teract *mydriasis* produced by atropin, to lessen tension in the early stages of *glaucoma*, and some nately with atropin to break up adhesions in *irit ipheral ulceration of the cornea*, in the absence of i acts better than atropin.

**Untoward Effects.**—Strong solutions instilled sometimes cause pain in the eye and head, sp ocular muscles, vertigo, and faintness.

**Administration.**—Physostigma may be give in the form of the extract, the tincture, or the alk hypodermic use physostigmin sulphate is preferable of its ready solubility in water. For the same sulphate should be employed in affections of th continued use it is generally prescribed in solution from $\frac{1}{8}$–1 gr. (0.008–0.065 gm.) to the ounce (30 when a powerful and prompt effect upon the ey much stronger solutions (2–3 gr.—0.13–0.2 gm.) t (30.0 c.c.) may be employed. On standing solutio turn red and lose some of their effectiveness.

## GELSEMIUM, U. S. P.

(Yellow Jasmine.)

Gelsemium is the rhizome and root of *Gelsem virens*, a climber indigenous to the southern Unite contains gelseminin and gelsemin. Gelseminin, sents to a considerable extent the active properties drug, occurs in the form of white crystals, with taste, sparingly soluble in water, and readily solubl ether, and dilute acids. The dose of gelseminin from $\frac{1}{120}$–$\frac{1}{30}$ gr. (0.0005–0.002 gm.).

| Preparations. | Dose. |
|---|---|
| Tinctura Gelsemii, U. S. P. . . . . | 5–20 min. (0.3 |
| Fluidextractum Gelsemii, U. S. P. . . . . | 1–5 min. (0.0 |

**Physiologic Action.**—**Circulatory System.**—Small doses do not affect the circulation, but very large doses quicken the pulse by depressing the ganglia on the inhibitory nerve.

**Nervous System.**—Gelsemium depresses the spinal cord, especially its motor neurons, and also, though less powerfully, the terminations of the motor nerves.

**Respiratory System.**—Toxic doses kill by paralyzing the respiratory center.

**Eye.**—Locally applied, gelseminin dilates the pupil and paralyzes accommodation, these effects being produced, as with atropin, by depression of the endings of the third nerve.

**Toxicology.**—Gelsemium-poisoning is characterized by vertigo, frontal headache, disordered vision, dilatation of the pupils, ptosis, falling of the jaw, failure of articulation, extreme muscular weakness, slow respiration, a weak, thready pulse, and, finally, collapse. Consciousness is usually retained until near the close of life. Convulsions have been observed in animals, but not in man.

**Treatment.**—Restorative measures consist in evacuating the stomach, administering tannic acid, maintaining the body-temperature, and combating collapse with such stimulants as strychnin, whisky, and ammonia.

**Therapeutics.**—Gelsemium has been employed as an antispasmodic in *laryngismus stridulus*, *whooping-cough*, *asthma*, and *chorea*, but in these affections there are far more efficient remedies. At one time gelseminin was recommended as a mydriatic, but homatropin and atropin are superior, being more prompt and less dangerous. The drug is sometimes distinctly useful in *spasmodic affections of the muscles*, like torticollis, and in *obstinate neuralgia*, especially of the trifacial nerve. In the latter, a combination of butyl-chloral hydrate (5 gr.—0.3 gm.) and gelseminin ($\frac{1}{100}$ gr.—0.0006 gm.), as recommended by Murrell, is particularly efficacious. Ringer has found it useful in some cases of *Ménière's disease*. On account of the variability of the preparations, they should be given in small doses, gradually increased until such symptoms as vertigo or dimness of vision appear. In persistent torticollis gelseminin may be injected directly into the muscle.

## OTHER SPINAL CORD DEPRESSANTS.

**Hydrated Chloral.**—The depressant action of hydrated chloral on the motor tracts of the spinal cord is secondary in importance only to that on the cerebrum. In *tetanus* and *strychnin-poisoning* it renders valuable service in allaying the irritability of the spinal motor neurons.

**Chloroform and Ether.**—These drugs depress both the sensory and motor neurons of the spinal cord, but the former more powerfully than the latter. They are useful in checking convulsions which endanger life, whether the motor discharges emanate from the brain or from the spinal cord. As spinal cord depressants they are of value in cerebral convulsions by lessening the power of the sensory columns to transmit to the brain stimuli from without, and also by lessening the power of the motor columns to convey discharges from the brain to the muscles.

**Bromids.**—The bromids depress the entire central nervous system, first the cerebrum, then the spinal cord, and lastly the medulla. As depressants of the spinal cord they are useful in subduing the convulsive seizures of *strychnin-poisoning* and *tetanus*.

---

## MOTOR NERVE DEPRESSANTS.

The most important depressants of the peripheral motor nerves are:

| | |
|---|---|
| Curare. | Conium. |
| Belladonna. | Gelsemium. |
| Lobelia. | Spartein. |

Pelletierin.

Of this group, however, only belladonna, conium, and, perhaps, lobelia are employed for their effect on the nerve-endings. *Curare* is a resinous extract, obtained from various species of *strychnos*, growing in South America. Taken by the mouth, it has little or no effect, but introduced into the body through an open wound or by subcutaneous or intravenous injection, it is a powerful paralyzant of the nerve-endings in all striated muscle except that of the heart. It has been used to some extent in hydrophobia and tetanus, but without much success. The dose is from $\frac{1}{20}$–$\frac{1}{2}$ grain (0.0032–0.032 gm.), subcutaneously. The action of *gelsemium* on the motor nerves is subordinate to its action on the central nervous system. *Pelletierin*, an alkaloid of pomegranate, affects the motor nerve-endings only in toxic doses. The action and uses of *belladonna* have been fully considered on page 75.

Motor nerve depressants are useful in local spasmodic affections like whooping-cough, torticollis, and asthma.

## CONIUM, U. S. P.

(Hemlock.)

Conium is the fruit of the *Conium maculatum*, gathered while yet green. It contains a volatile oil and a yellowish, oily, liquid alkaloid, *coniin*, which represents the active properties of the drug. Coniin forms with acids crystallizable salts which are soluble in water. The dose of the alkaloid or its salts is from $\frac{1}{20}$–$\frac{1}{6}$ gr. (0.003–0.01 gm.).

| Preparations. | Dose. |
|---|---|
| Fluidextractum Conii, U. S. P. . . . . | 2–5 min. (0.1–0.3 c.c.). |
| Extractum Conii . . . . . | ½–2 gr. (0.03–0.13 gm.). |
| Tinctura Conii . . . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |

**Physiologic Action.**—Toxic doses of conium produce a staggering gait, muscular relaxation, paralysis, tremors, vertigo, ptosis and dilatation of the pupils (from paresis of the oculomotor nerve), coldness of the surface, and, finally, death from asphyxia. Salivation, nausea, vomiting, and diarrhea may also be observed. Consciousness and sensibility are preserved until near the end.

The dominant action of the drug is on the peripheral motor nerves, which it paralyzes. Its action on the spinal cord consists of transient stimulation, followed by profound depression. On the brain it exerts no special influence.

Whether the failure of respiration observed in poisoning is the result of paralysis of the respiratory center or of the nerve-endings in the diaphragm has not definitely been determined. Except in very large doses, conium has but little depressant effect on the heart.

**Therapeutics.**—Conium has been used as an antispasmodic in *chorea*, *paralysis agitans*, *asthma*, and *whooping-cough*, but in these affections it is of less value than other remedies. In the form of vapor it is sometimes useful in allaying the cough of *bronchitis*. Spitzka and others strongly recommend it in the mental and physical excitement of *acute mania*. On account of the uncertain strength of the preparations, it is necessary to give the drug in small doses rapidly increased until some effect is produced.

## LOBELIA, U. S. P.

Lobelia is the leaves and tops of *Lobelia inflata*, a weed growing in the wild places of Canada and the United States. It contains *lobelic acid* and a yellow liquid alkaloid, *lobelin*. The latter forms, with acids, crystalline salts, which are soluble

in water. The dose of the sulphate of lobelin is fr
(0.01–0.06 gm.).

| Preparations. | Dose. |
|---|---|
| Tinctura Lobeliæ, U. S. P. . . . . | As an expectorant, (0.6–2.0 c.c.). As an emetic, 1–2 f c.c.). |
| Fluidextractum Lobeliæ, U. S. P. . . . | As an expectorant, 2 0.3 c.c.). As an emetic, 20– 2.0 c.c.). |

**Physiologic Action.**—Lobelia has practically action as conium, except that it is more prone tha to produce nausea and vomiting. It paralyzes the terminations of the motor nerves, and appears to be depressant to the endings of the vagus distribut bronchial muscles. The ingestion of a large dose o (a teaspoonful of the tincture) is followed by nausea and faintness. Toxic doses cause severe burning p esophagus and stomach, persistent vomiting, col weakness of the pulse, extreme prostration, and, fin from paralysis of the respiratory center.

The treatment of *lobelia-poisoning* consists in the a tion of tannic acid and of diffusible stimulants, and of artificial heat to maintain the bodily temperatu

**Therapeutics.**—Lobelia was formerly used as but as such it has been almost entirely displaced b pressing drugs. It is, however, an exceedingly u spasmodic in *asthma* and in *bronchitis* associated modic dyspnea. To secure the best results, it is to give the drug in increasing doses until slight produced.

## SPARTEINÆ SULPHAS, U. S. P.

Spartein is a liquid alkaloid obtained from the tops *Scoparius*, or common broom. It is official as *Spa phas*, a white crystalline or granular powder of a bitter taste, and freely soluble in water and alcohol. of spartein sulphate is ¼ grain (0.015 gm.), cautiously to 1 grain (0.06 gm.).

**Physiologic Action.**—Spartein closely resemb in its action, though it has less effect on the centra system, and is less poisonous than the latter. As with coniin, large doses depress the motor nerve-en the sympathetic nerve cells. The drug also dep

heart directly, and so lessens both force and frequency of the cardiac contractions. Under its influence the blood-pressure usually falls, though at first it may slightly rise from constriction of the peripheral vessels. Spartein has been employed rather extensively as a substitute for digitalis in cardiac insufficiency, but the actions of the two drugs are entirely dissimilar.

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## SENSORY NERVE DEPRESSANTS.

When applied locally a drug may lessen or destroy sensibility through a specific action on the peripheral nerves, or, as is the case with ether and ethyl chlorid, through the intense cold produced by its evaporation. A few drugs when taken internally, if the dose be sufficiently large, are capable of producing numbness of the skin and mucous membranes through a peripheral action. This is true of *aconite* and the *bromids*.

Sensory nerve depressants are employed locally to relieve pain and to allay itching.

The following agents act as local anesthetics:

| | | |
|---|---|---|
| Cocain. | | Menthol. |
| Tropacocain. | | Camphorated chloral. |
| Eucain. | Esters of benzoic acid. | Phenol. |
| Orthoform. | | Iodoform. |
| Anesthesin. | | Aconite. |
| Stovain. | | Veratrin. |
| Novocain. | | Hydrocyanic acid. |
| Holocain. | | Ethyl chlorid. |
| Chloretone. | | Ether. |

Many of the *aromatic oils*, like oil of cloves and oil of peppermint, also possess anodyne properties.

**Cocain** (see p. 83).—The application of a cocain solution of moderate strength (6 per cent.) to a mucous membrane is followed in a few moments by pallor and anesthesia. The pallor is due to constriction of the blood-vessels, and is subsequently replaced by congestion; the anesthesia is due to the direct action of the drug upon the sensory nerves. Applied to cutaneous surfaces it is without effect, since absorption through the skin is very slight. In the eye it causes, in addition to anesthesia, mydriasis and a slight impairment of accommodation.

The uses of cocain as a local anesthetic are various. *In operations on the eye, nose, throat, urethra, and rectum*, its solutions are indispensable in preventing or in lessening pain.

When injected under the skin it is also of establish in many *minor operations involving the cutaneous s* such as circumcision, opening small abscesses, an fingers, and excising small growths.

In *inflammations* and *ulcerations of the nose, phar larynx* it may be employed alone or in combination septic sprays and powders. In *acute coryza* and *ha* gives much relief by lessening the sensibility and th cence of the tissues. In *tuberculous laryngitis* it serve purpose in lessening the intense pain and dysphag also efficacious in diminishing the pain caused by the tion of caustics.

For anesthetizing mucous membranes solutions ployed varying in strength from 2–20 per cent. On and throat from 4–6 per cent. solutions are usually In the larynx somewhat stronger solutions are Solutions stronger than 4 per cent. should not be us eye on account of the danger of inducing degenerative in the corneal epithelium. When the drug is emplo cutaneously after the method of Schleich, it is not saf more than 1 grain to remain in the tissues.

**Eucain.**—Eucain is a synthetic compound allie cally to cocain. Two forms are upon the market, known respectively as Alpha-eucain or eucain hyd "*α*" and Beta-eucain or eucain hydrochlorid "*β* former, on account of its irritant properties, has bee completely supplanted by the latter. Beta-eucain oc white, neutral, crystalline powder, soluble in about of cold water, making a 3 per cent. solution. It is less toxic than cocain, and, moreover, its solutions stable, and can be sterilized by boiling without losin cacy. A disadvantage of eucain is that it has no co influence on the blood-vessels, in consequence of causes hyperemia rather than ischemia. When inje cutaneously it is somewhat more liable than cocain sloughing.

For general surgical purposes a 2 per cent. soluti 1 oz.—0.6 gm.–30.0 c.c.) is generally employed.

**Holocain.**—Holocain is a synthetic compoun chemically to phenacetin. The hydrochlorid, in wh it is always employed, occurs in colorless crystals, bitter taste and slightly soluble in cold water.

It is very sensitive to alkalies—even the small a alkali dissolved out of the glass on boiling a soluti drug in a test-tube is sufficient to decompose it.

Experimentally holocain has been found to be more actively poisonous than cocain, and therefore it is not suitable for subcutaneous use. It has qualities, however, which make it a very valuable anesthetic in ophthalmic surgery. The instillation into the eye of a few drops of a 1 per cent. solution of holocain causes slight burning, and is followed in from twenty to thirty seconds by complete anesthesia, lasting for from ten to fifteen minutes. It is without effect upon the pupil, the ciliary muscle, the intra-ocular tension, or the corneal epithelium. It is more rapid in its action than cocain, and it has, moreover, some bactericidal power. As it has no constricting effect upon the blood-vessels, it lacks the power of cocain to control hemorrhage.

Since it acts so quickly and does not cause mydriasis, it is especially valuable in *minor operations on the eye*, such as the removal of foreign bodies. Norris has found it very efficacious in *sluggish corneal ulcers*, and de Schweinitz and others have spoken favorably of it in *keratitis*.

A 1 per cent. solution is usually employed. When the eye is inflamed, the effectiveness of both holocain and cocain is distinctly enhanced by the previous application of a solution (1 : 10,000) of adrenalin.

**Tropacocain Hydrochlorid.**—Tropacocain is an alkaloid obtained from the small Java coca leaves. It forms white needles which are readily soluble in water. It resembles cocain in its action, but it is much less toxic, and when applied to mucous membranes it does not cause ischemia.

It anesthetizes the eye without affecting the pupil or accommodation, but it has no advantages over holocain. On account of its lesser toxicity it may replace cocain in solutions intended for infiltration anesthesia, especially when it is necessary to employ large doses of the anesthetic. Block recommends the following solution:

| | |
|---|---|
| Tropacocain hydrochlorid, | 3 gr. (0.2 gm.); |
| Sodium chlorid, | 3 gr. (0.2 gm.); |
| Sterilized distilled water, | 3 fl. oz. (100.0 c.c.). |

It has also been used successfully in the production of medullary anesthesia, from $\frac{3}{5}$–$\frac{4}{5}$ gr. (0.26–0.05 gm.) being injected for this purpose into the subarachnoid space.

**Orthoform.**—This synthetic compound is the methyl-ester of meta-amido-para-oxybenzoic acid. It occurs as a white, voluminous powder, without odor or taste, and sparingly soluble in water. Orthoform hydrochlorid is freely soluble in water, but it is too irritating for general use. Orthoform

has pronounced analgesic, antiseptic, and desiccant
and for this reason it has been recommended as a dr
painful wounds and ulcers.

When applied pure or in the form of an ointme
per cent.) to exposed sensory nerve-endings it caus
burning sensation, which is soon followed by comp
gesia lasting from ten to twenty hours. The prolon
of the drug is due in large part to the slowness wit
is absorbed. On account of its acid reaction it is to
to be applied to sensitive mucous membranes like the
be injected hypodermically. Unfortunately it is not
free from toxic properties, and its effects should be
watched. Brocq, Asam, Yonge, and others have s
sive erythema, urticaria, eczema, and even gangrene
use. A study of the published records indicates
accidents are more likely to occur from the use of t
an ointment than when it is applied directly in the
powder.

Orthoform has been used successfully as a local
*painful wounds*, in *burns*, especially of the third
*cancerous* and *tuberculous ulcerations*, and in *fissur*
*coriations* of the mucocutaneous junctions. It will
very efficacious in relieving the pains of *tuberculous*
and of *fissured nipples*. In the former the powdered
be used; in the latter, a saturated alcoholic soluti
ethereal solution like the following, recommended b

| | | |
|---|---|---|
| ℞ | Orthoform | gr. lxxx (5.0 gm.) |
| | Ætheris, | q. s. ad solv.; |
| | Olei amygdalæ expressi, | ℥j (30.0 c.c.). |

Added to arsenical pastes (orthoform, 1 part; acac
arsenous acid, 2 parts) it materially lessens the pain
their caustic action. Its internal use in doses of fro
(0.3–0.65 gm.) has been recommended in *gastric*
*cancer*, but Epstein has observed vomiting and col
its administration by the mouth.

Orthoform is incompatible with silver nitrate, ant
bismuth subnitrate.

**Anesthesin.**—This is the ethyl ester of param
acid. It is a white, inodorous powder, tasteless, but
a sense of numbness when applied to the tongue. I
insoluble in water, soluble to the extent of 2 or 3
oils, and readily soluble in alcohol. As a local anest
thesin has an action very similar to that of orthofor
irritant and less toxic. Locally, it is employed by

in *pharyngeal* and *laryngeal affections*, as a dusting-powder or ointment in *burns* and *painful ulcerations of the skin*, and in the form of suppositories in *hemorrhoids*. Internally, it has been used with some success in relieving pain and vomiting the result of *gastric ulcer* or *cancer*. The dose is from 5 to 10 grains (0.3–0.65 gm.), preferably in cachets.

**Stovain.**—This synthetic compound—the hydrochlorid of an ester of benzoic acid—appears as small white lustrous crystals, very freely soluble in water. It is about equal to cocain in anesthetic power, but less toxic, and, moreover, has a vasodilating instead of a vasoconstricting effect. It has been recommended particularly for local injections in *minor surgical operations* (0.5 to 1 per cent. to the extent of 2 grains—0.13 gm.) and for *lumbar anesthesia* (10 per cent. solution to the extent of $\frac{1}{2}$ to $1\frac{1}{6}$ grains—0.03–0.07 gm.). In a few instances gangrene has been observed after subcutaneous injections. It may be applied to the conjunctiva in 4 per cent. solution, and to other mucous membranes and ulcerated surfaces in from 5 to 10 per cent. solution. In prescribing stovain it should be borne in mind that it is incompatible with alkalis and mercuric salts.

**Novocain** is a benzoic acid ester occurring as a crystalline salt, soluble in an equal weight of water. It is a powerful local anesthetic, more transient in its effect than cocain, but much less toxic and irritant. It may be applied in a 1 to 10 per cent. solution to the eye and in a 5 to 20 per cent. solution to the nose and larynx, with the addition of a little adrenalin solution to prolong the anesthesia. For infiltration anesthesia, a solution of 1 to 2 per cent., also with adrenalin, may be used to the extent of 3 or 4 grains (0.2–0.25 gm.) without fear of toxic effects. It is incompatible with alkalis and alkaline carbonates.

**Chloretone** (see p. 106).—This is a compound formed by the addition of potassium hydrate to equal weights of chloroform and acetone. It appears as a white, crystalline powder, with a camphoraceous odor and taste. In addition to its usefulness as a hypnotic it has a definite value as an antiseptic and a local anesthethic. It has been used with considerable success as a dusting-powder in *painful wounds*. It has also been employed in the form of a saturated solution for producing infiltration anesthesia, but the results have not been uniformly favorable.

**Menthol** (peppermint camphor).—Menthol is a stearopten obtained from the essential oil of peppermint. It occurs as colorless prismatic or acicular crystals, having the odor of

mint and a camphoraceous taste. It is sparingly water, but freely so in alcohol, ether, and chlorof dose is from 1–3 gr. (0.06–0.2 gm.), in pills, caps alcoholic solution.

Menthol is employed as a local anesthetic and an It makes a useful application in *frontal headache* a *ralgia of the superficial nerves.* For use in these a is best dissolved in chloroform or ether. When e of chloral or menthol are heated together in a wat oily liquid is formed (chloral menthol), which is in *toothache.* One part of menthol to 10 of olive a soothing application for *burns.* Dissolved in cc the proportion of 1 : 4 it forms a useful dressing *contusions.* The inhalation of menthol in the form or spray affords considerable relief from the disagree toms of acute *coryza.* The following solution will useful in both coryza and acute laryngitis:

℞ Menthol, gr. vj (0.4 gm.);
Eucalyptol, ♏v (0.3 c.c.);
Petrolati liquidi, f℥j (30.0 c.c.).—
Sig. To be used as a spray several times a day.

Liquid petrolatum containing from 5–10 per cen thol makes an excellent vehicle for various remedies in the treatment of *chronic rhinitis* and *chronic laryn*

The following mixture in the form of a spray recommended as a local anesthetic in minor surgi tions:

℞ Menthol, gr. x (0.65 gm.);
Chloroformi, f℥v (18.5 c.c.);
Ætheris, f℥j (30.0 c.c.).—

Internally, menthol is sometimes used in persist *ing* and *gastralgia*, but it is rarely successful.

**Ethyl Chlorid** (see p. 129).—This compound is by the action of dry hydrochloric acid gas on absolu On account of the intense cold caused by its rapid tion it is employed as a local anesthetic. It is usua small glass tubes, provided with a lever-spring top. lever is depressed, the liquid is expelled as a spray b of the hand.

Ethyl chlorid is a convenient local anesthetic *minor operations* requiring but a single incision, such boils and aspirating pleural or abdominal effusic seldom efficient in operations upon the deeper requiring dissection or curetting.

As a permanent opacity may result when freezing mixtures come in contact with the cornea, caution must be exercised in using ethyl chlorid about the head (Merz-Weigandt).

**Phenol** (see p. 387).—As a local anesthetic phenol acid is chiefly employed to allay itching in *jaundice* and *pruritic* skin diseases like eczema and urticaria. It may be used in the strength of 1½–2 dr. (5.8–7.8 gm.) to the pint (0.5 L.) of water

**Iodoform** (see p. 319).—On account of its analgesic properties iodoform is a valuable topical remedy in various *ulcerations of a painful character*. It is particularly useful in relieving the pain and dysphagia of tuberculous laryngitis, in which affection it is employed by insufflation, either in a pure form (2–3 gr.—0.13–0.2 gm.) or mixed with morphin ($\frac{1}{16}$–$\frac{1}{12}$ gr.—0.004–0.005 gm.). Suppositories of iodoform are often of service in painful hemorrhoids and in fissure of the anus.

**Camphorated Chloral.**—This is a syrupy liquid made by rubbing together equal parts of camphor and hydrated chloral. It is soluble in alcohol, ether, glycerin, and oils, but it is decomposed by water. It is used as a local anesthetic in *neuralgia*, *toothache*, and *pruritus*. In local pruritus the following ointment is sometimes efficacious:

℞ Pulveris camphoræ,
Pulveris chlorali hydrati, āā ʒj (4.0 gm.);
Trit. et add.
Unguenti aquæ rosæ, ℥j (30.0 gm.).—M.

**Aconite** (see p. 60).—The tincture of aconite, rubbed into the affected part, is sometimes useful in relieving the pain of *neuralgia* and in allaying the itching of *chilblains*. Ointments containing aconitin (5–10 gr. to the ounce—0.3–0.6 gm. to 30.0 gm.) are also prescribed in neuralgia, but on account of the extreme virulence of the alkaloid they must be used with great caution. Liniments containing aconite and chloroform are employed with benefit in *muscular rheumatism*.

**Veratrin** is an alkaloid obtained from the seed of *Asagræa officinalis*, a bulbous herb growing in Mexico and Central America. The official preparation is a mixture of pure veratrin and a number of other less active alkaloids. It is a white, amorphous, or semicrystalline powder, odorless and intensely acrid. It is readily soluble in alcohol, but very slightly so in water.

Veratrin has an action very similar to that of aconitin. In the form of the ointment (*Unguentum Veratrinæ*, U. S. P.) or oleate (*Oleatum Veratrinæ*, U. S. P.) it is occasionally employed as a local remedy in *neuralgia*. It should never be applied

over large surfaces or where there are any abrasions. In employing it about the face great care must be exercised to keep it out of the eye.

**Hydrocyanic** or **prussic acid** is employed in medicine only in very dilute solution. The official preparation (*Acidum Hydrocyanicum Dilutum*), a 2 per cent. aqueous solution, is a colorless liquid with the odor and taste of bitter almonds. The dose is from 1 to 3 min. (0.05–0.2 c.c.).

Hydrocyanic acid is a general protoplasmic poison. In moderate doses it first stimulates and then powerfully depresses the central nervous system, especially the respiratory vasomotor and cardio-inhibitory centers in the medulla. It also depresses the heart or its contained motor ganglia, and decreases all metabolic processes. Large doses kill almost immediately, the heart and respiration being arrested simultaneously. After death the blood often retains for a time its bright red color, owing to the formation of cyanhemoglobin, a compound that is less readily reduced than oxyhemoglobin. Hydrocyanic acid is partially destroyed in the tissues and partially transformed into sulphocyanides, which escape in the urine. Locally applied, even in dilute solution, it produces numbness of the part by depressing the endings of the sensory nerves.

*Toxicology.*—When death is not immediate, the characteristic symptoms of prussic acid poisoning are a sense of numbness in the mouth, salivation, dyspnea, dilatation of the pupils, infrequent pulse, clonic convulsions, involuntary discharge of urine and feces, unconsciousness, and collapse. Treatment is rarely effectual on account of the very rapid action of the drug. It consists in artificial respiration and the use of such stimulants as strychnin and atropin. Sodium hyposulphite has also been recommended in order to form an innocuous sulphocyanide.

In the form of lotion hydrocyanic acid is sometimes used to relieve itching in *eczema* and *pruritus* when there is no abrasion of the skin. Internally, it is often of service in relieving *gastralgia* and controlling the pain and vomiting of *gastric ulcer* and *cancer*. It has also been used largely to allay cough in *advanced phthisis*. Dilute prussic acid is very prone to decomposition, and, therefore, the preparations on the market vary considerably in their value. The following formulæ will illustrate the manner in which the drug may be prescribed:

℞ Acidi hydrocyanici diluti, ʒss (2.0 c.c.);
Glycerini, ʒj (4.0 c.c.);
Aquæ, q. s. ad ʒij (60.0 c.c.).—M.
Sig. Apply as directed. (*Pruritus.*)

℞ Bismuthi subnitratis, ℥ss (15.0 gm.);
Acidi hydrocyanici diluti, ♏xl (2.5 c.c.);
Aquæ, q. s. ad f℥iv (120.0 c.c.).—M.
Sig. Shake well. A dessertspoonful before meals. (*Gastric ulcer or catarrh.*)

℞ Codeinæ sulphatis, gr. iv (0.25 gm.);
Acidi hydrocyanici diluti, ♏xxxij (2.0 c.c.);
Syrupi tolutani, q. s. ad f℥ij (60.0 c.c.).—M.
Sig. A teaspoonful every four hours. (*Cough of phthisis.*)

**Ether** (see p. 118).—The application of ether in the form of a spray is one of the oldest methods of producing local anesthesia. The sensory nerves are benumbed by the intense cold which is occasioned by the rapid evaporation of the drug. This method may be employed preliminary *to opening small abscesses* or *performing paracentesis.*

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## MYDRIATICS.

The size of the pupil is regulated by the unstriped muscle-fibers of the iris, of which there are two sets—concentrically arranged constrictor fibers and radiating dilator fibers. Two antagonistic nerves control these muscles: the oculomotor, which when stimulated contracts the pupil through the agency of the constrictor fibers, and the sympathetic, which when stimulated dilates the pupil through the agency of the dilator fibers.

*Mydriasis* or dilatation of the pupil may be brought about in a variety of ways: By paralyzing the oculomotor center in the medulla; by paralyzing the peripheral filaments of the oculomotor nerve; by paralyzing the constrictor muscle of the iris; by stimulating the sympathetic center in the medulla; by stimulating the peripheral fibers of the sympathetic nerve, or by stimulating the radiating muscular fibers of the iris itself.

All mydriatics impair more or less the *accommodative power* of the eye; that is, its power of adjusting itself to vision at different distances. The agency through which the adjustment is effected is the ciliary muscle. In accommodating for near objects this muscle contracts, the suspensory ligament relaxes, the lens, owing to its inherent elasticity, becomes more convex. Of the mydriatics, *hyoscin*, *hyoscyamin*, and *atropin* are the most powerful *cycloplegics* or paralyzants of the ciliary muscle, and *cocain* and *euphthalmin* are the least powerful.

Another property of mydriatics is their power of *increasing the intra-ocular tension*, and so favoring the development of

glaucoma when a tendency to that affection alrea
Dilatation of the pupil mechanically increases the ir
pressure by narrowing the angle between the iri
cornea, thus impeding the escape of humor fron
through the small openings communicating with th
Schlemm. Of the mydriatics, *cocain* and *euphthalmi*
least effect on the intra-ocular tension.

Mydriatics are employed to facilitate ophthalmo
amination, to paralyze accommodation when estimat
tive errors, to rest the iris and to prevent or break l
sions in iritis, to enlarge the field of vision in nuclea
when the periphery of the lens is still clear, an
irritation in inflammation of the cornea.

The most important local mydriatics are:

| | |
|---|---|
| Atropin. | Hyoscin or scop |
| Homatropin. | Cocain. |
| Methylatropin (eumydrin). | Euphthalmin. |
| Hyoscyamin. | |

**Atropin Sulphate** (see p. 75).—Atropin dilates
by paralyzing the oculomotor nerve-endings in th
muscle of the iris, and destroys the power of acco
by paralyzing the nerve-endings in the ciliary musc
increases the intra-ocular tension. After the instal
the eye of a drop or two of a solution of atropin
oz.—0.26 gm.–30.0 c.c.) mydriasis begins in fiftee
and attains its maximum in about half an hour.
dation is not affected so quickly, paralysis not bein
within an hour and a half. On the other hand,
persists somewhat longer than the suspension of ac
tion. The effect of an atropin solution of the strengt
does not usually disappear completely for about te

Atropin may be used as a simple mydriatic to *fa*
*thalmoscopic examination*, but euphthalmin, cocain,
atropin are as efficient for this purpose and cause
venience to the patient. As it paralyzes accommo
a reliable mydriatic for general use in *refraction*
many ophthalmologists prefer cycloplegics whic
less persistent action. In *iritis* it is indispensable in
and in breaking up adhesions between the iris and
of the lens. In *acute keratitis* it is also very useful
ciliary irritation.

As a simple mydriatic $\frac{1}{4}$ gr. (0.016 gm.) to the
c.c.) is sufficient, and the mydriasis from this solutio

last longer than four or five days. As a cycloplegic, a solution of 4 gr. (0.26 gm.) to the ounce (30.0 c.c.) should be instilled into the eye, one drop at a time, three times for at least a day. A solution of the same strength is generally used in iritis. In keratitis a solution containing 1–2 gr. (0.65–0.13 gm.) to the ounce (30.0 c.c.) will be effective.

**Homatropin Hydrobromid.**—Homatropin is an artificial alkaloid obtained by heating tropin (a component of atropin) with mandelic acid, in the presence of dilute hydrochloric acid. It is employed in the form of the hydrobromid (*Homatropinæ Hydrobromidum*, U. S. P.), which is freely soluble in water.

Like atropin, it dilates the pupil and paralyzes accommodation. Its action is complete within an hour, and lasts from two to three days. It has an advantage over atropin in the shorter duration of its effects. It is, however, several times more costly than the natural alkaloid. To paralyze the accommodation a solution of 8–12 gr. (0.5–0.8 gm.) to the ounce (30.0 c.c.) must be instilled in the conjunctival sac six or eight times at intervals of five or ten minutes. In facilitating ophthalmoscopic examination a solution of 1–2 gr. (0.06–0.13 gm.) to the ounce (30.0 c.c.) is sufficient.

**Methylatropin** or **eumydrin** has properties similar to those of atropin, though it is not so poisonous. As a mydriatic it acts more quickly than atropin, but its effects are less lasting. It is applied in from 1 to 2 per cent. solution.

**Hyoscyamin** (see p. 81).—This alkaloid is obtained from hyoscyamus and other *Solanaceæ*. It is official in the form of hydrobromid (*Hyoscyaminæ Hydrobromidum*) and the sulphate (*Hyoscyaminæ Sulphas*), both of which salts are freely soluble in water. Upon the eye hyoscyamin acts like atropin in dilating the pupil and paralyzing the accommodation, but its effects are less lasting, being not more than six or seven days in duration. Some ophthalmologists prefer it to atropin for this reason. It is usually employed in the strength of 2 grains (0.13 gm.) to the ounce (30.0 c.c.).

**Hyoscin or Scopolamin Hydrobromid** (see p. 82).—This drug dilates the pupil, paralyzes accommodation, and increases intra-ocular tension in the same way as atropin; but it acts more powerfully and quickly and its effects are of much shorter duration. Its chief drawback is its greater tendency to cause constitutional disturbance. It may be employed in the strength of 4 grains (0.26 gm.) to the ounce (30.0 c.c.).

**Cocain Hydrochlorid** (see p. 83).—The instillation into the eye of a few drops of a 4 per cent. solution of cocain causes, in from ten to fifteen minutes, in addition to local anes-

thesia, marked dilatation of the pupil. The mydria its maximum in about an hour, and persists for fr to fifteen hours. It is of peripheral origin, and is caused by stimulation of the sympathetic nerves. C slightly impairs accommodation. In strong solutio an injurious effect upon the corneal epithelium.

As the effect of cocain on the pupil is of short and as it does not seriously disturb accommodati convenient mydriatic for *retinal examinations.* In iri is distinctly preferable on account of its forcible a lasting effect. The mydriasis induced by cocain overcome by the instillation into the eye of a few 1 per cent. solution of eserin. Stronger solutions than 4 per cent. should not be used in the eye on a the danger of causing degenerative changes in t epithelium.

**Euphthalmin.**—This synthetic alkaloid is t chlorid of the mandelic acid derivative of eucain B. in the form of a white crystalline powder, solub water. Its solution can be sterilized by boiling, thus be kept for a long time. If a few drops of a solution be placed in the conjunctival sac, mydriasis a few minutes, attains its maximum in about hal and passes away within six or seven hours. Whil of action has not been fully determined, it is probab drug dilates the pupil by paralyzing the peripheral e oculomotor nerve. Euphthalmin does not injure t epithelium; it does not irritate the conjunctiva; it to no constitutional disturbance; and it only sligh accommodation. Contrary to what has been stated it does increase to some extent the intra-ocular t Knapp has observed glaucoma follow the use of cent. solution. On account of the brief duration o on the pupil, and its slight cycloplegic influence, it the best agent we possess for *simple ophthalmoscopi* Solutions varying from 4 to 6 per cent. are usually According to Jackson the following solution is mo dilating the pupil and at the same time less persi effect than a stronger solution of euphthalmin alone

| | |
|---|---|
| Euphthalmin, | 1 part; |
| Cocain hydrochlorid, | 1 " |
| Distilled water, | 100 parts. |

# MYOTICS.

*Myosis* or contraction of the pupil may result from causes the reverse of those mentioned as being capable of bringing about mydriasis. *Morphin*, when taken internally in large doses, contracts the pupil by stimulating the oculomotor center. *Physostigmin* and *pilocarpin*, applied quickly to the eye, cause contraction of the pupil by stimulating the peripheral endings of the oculomotor nerve, and probably also the iris muscle itself. Both drugs also lessen intra-ocular tension by widening the angle between the iris and the cornea, thus favoring the escape of humor from the eye, and, in strong solution, induce spasm by accommodation. *Arecolin* apparently has a similar action.

**Physostigmin or Eserin Sulphate** (see p. 146).—This is the most commonly used myotic. When a gentle, continuous action is desired, a solution containing from $\frac{1}{8}$–1 gr. (0.008–0.065 gm.) to the ounce (30.0 c.c.) is sufficient, but when a prompt and powerful action is necessary, a solution containing from 2–3 gr. (0.13–0.2 gm.) to the ounce (30.0 c.c.) may be employed. The maximum effect of these solutions is secured in from one-half to three-quarters of an hour, and persists from a few hours to several days. On standing, solutions of physostigmin turn red and lose some of their effectiveness.

**Pilocarpin Hydrochlorid** (see p. 258).—The action of pilocarpin on the eye is very much like that of physostigmin, but less powerful. It is employed in solution of from 1–4 gr. (0.065–0.26 gm.) to the ounce (30.0 c.c.).

**Arecolin Hydrobromid.**—This is the hydrobromid of a liquid alkaloid obtained from *areca catechu*, or betel-nut. It is a white crystalline salt, soluble in water. In the form of $\frac{1}{2}$ or 1 per cent. solution ($2\frac{1}{4}$–$4\frac{1}{2}$ gr. to the ounce—0.14–0.3 gm. to 30.0 c.c.) it is a powerful myotic. Contraction of the pupil begins in from three to five minutes, reaches its maximum in from ten to fifteen minutes, and is accompanied by spasm of the ciliary muscle. The pupil returns to its normal condition within an hour or two. Its action is more rapid, but at the same time more transient, than that of physostigmin. Its power of lowering tension in *glaucoma* is apparently equal to that of eserin, and in Bietti's hands it proved successful in a case of glaucoma in which physostigmin had failed.

Arecolin has been used with asserted success as an anthelmintic, and, according to Frohner and Clemesma, it is, when injected hypodermically, a more powerful sialagogue than pilocarpin.

# EMETICS.

Vomiting is a reflex act consisting of a forcible
contraction of the abdominal muscles and diaphragı
the contraction of the muscular coat of the stor
assist in the act, it is not an essential factor, for
found that when the stomach was removed and wa
by a bladder filled with water, emesis could still oc
afferent impulses which excite vomiting travel from
ach through the sensory fibers of the vagus to a ce
medulla closely connected with the respiratory c
thence the efferent impulses are conducted thı
phrenics, the spinal nerves, and the vagus to th
concerned in the act.

Theoretically, a drug may cause vomiting either b
affecting the center in the medulla or by indirectl
it through irritation of the sensory nerve-endin
stomach. It is not always an easy matter to dete
exact mode of action of an emetic. If the drug b
into a vein, it may act directly on the vomiting cente
eliminated through the stomach, it may act reflex
tating the sensory nerves of that organ; or again, i
be given by the mouth, it may irritate the stomacl
voke emesis through a reflex action, or, being al
may excite the vomiting center directly. If, howev
acts more promptly when injected subcutaneously
it is given by the mouth, and if vomiting follows it
after the stomach has been replaced by a bladder
water, or after all the arteries leading to the stor
been ligated, it may be assumed that its action i
direct one on the center in the medulla. The
*apomorphin* is purely central, while that of *copper su*
*sulphate*, *yellow sulphate of mercury*, *alum*, *mustard*,
*antimony* is probably entirely peripheral, although sc
believe that the last two drugs have some direct ir
the medulla.

Emetics may be employed for one of three pur
expel irritating food or poisons from the stomach
foreign bodies, false membrane, or excessive secr
the respiratory tract; and to expel mucus and bil
gall-ducts in catarrhal jaundice.

Emetics should be avoided or used with extreme
advanced pregnancy and in persons suffering from
atheroma, or hernia.

**Apomorphin Hydrochlorid** (see p. 273).—T

the most prompt and reliable emetic that we possess; moreover, it causes little nausea, and it is effective when administered hypodermically. It is very useful in *poisoning*, especially when swallowing is impossible, or when the state of the stomach is such as to prohibit the use of a mechanical or irritant emetic. In *acute alcoholism* it is exceedingly effectual. In some cases of narcotic poisoning, on account of the decreased sensitiveness of the medullary center, apormorphin, like other emetics, may prove inactive. As an emetic the drug should be administered hypodermically, although it will provoke vomiting when given by the mouth if the dose be sufficiently large. It must be borne in mind that in the very young and infirm considerable depression may attend its action. The dose is from $\frac{1}{12}$–$\frac{1}{6}$ gr. (0.005–0.01 gm.). Solutions are most conveniently prepared from tablets containing the requisite dose. Both tablets and solution are liable to deteriorate with age and on exposure to light and air.

**Ipecacuanha** (see p. 269).—This drug is a safe and fairly prompt emetic. Its action is not so vigorous or so depressing as that of the mineral emetics. It is especially adapted for children, in whom it may be employed to unload the stomach of irritant food or to expel tenacious mucus from the air-passages. The syrup and the wine are eligible preparations, and either may be given to children in doses of from ½–2 fl. dr. (2.0–8.0 c.c.).

**Tartar Emetic** (see p. 271).—The use of antimonial preparations as emetics is fortunately obsolescent. As their action is slow and is attended with prolonged nausea and depression, apomorphin, ipecacuanha, zinc sulphate, or mustard should always be selected in their stead.

**Zinc Sulphate** (see p. 367).—As an emetic zinc sulphate is employed chiefly in *narcotic poisoning*. The dose is from 10–30 gr. (0.65–2.0 gm.), repeated in fifteen or twenty minutes, if necessary.

**Copper Sulphate** (see p. 366).—This drug is a more prompt and powerful emetic than zinc sulphate. In *phosphorus poisoning* it serves a double purpose: it not only unloads the stomach, but it also acts as a partial antidote by coating the phosphorus with an insoluble phosphid of copper. The dose of copper sulphate is from 5–10 gr. (0.3–0.65 gm.), and when this amount has been administered without effect, it is best not to repeat it, but to resort to some other emetic.

**Mercury Subsulphate (Turpeth Mineral).**—This drug was formerly used in doses of 2–3 gr. (0.13–0.2 gm.) as an emetic in croup. Although certainty, quickness of action,

tastelessness, and small bulk are in its favor, it ca
recommended on account of its exceedingly irritant pr

**Alum.**—Powdered alum is a safe but somewhat u
emetic. It may be given to children in doses of a teas
in syrup, and repeated once or twice if vomiting c
ensue.

**Mustard.**—Mustard flour is a prompt and energetic
It may replace zinc sulphate or copper sulphate in
*poisoning*. It is contraindicated when there is acute
The dose is a tablespoonful stirred up in a glass of wa
repeated in ten or fifteen minutes if necessary.

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## ANTI-EMETICS.

The treatment of vomiting must be modified acco
the cause. In the vomiting of intestinal obstruction i
in rare instances that anything short of operative inte
brings relief. Severe vomiting is sometimes an earl
festation of chronic Bright's disease, and when suc
case, gastric sedatives are of little avail; our main
must be on eliminant measures. Reflex vomiting is
common, and may be associated with lesions in vario
of the body, as the bowel, gall-bladder, kidney, lung,
ear, or the uterus or its appendages. In this type of
treatment, to be really curative, must be directed to t
inal cause.

The exact etiology of the vomiting of pregnancy
undetermined, and hence its treatment must be in a
empiric. There is a growing conviction, however, tha
emesis gravidarum is dependent upon several co-c
factors, the most important of which are the presenc
blood of irritant toxins; reflex irritation from uterine
ment or from inflammatory lesions of the uterus or its
ages; circulatory disturbances in the medulla; and, fi
certain cases, a neurotic or hysteric element. In this
vomiting remedies directed solely to the stomach g
prove ineffective. To rid the body of noxious materia
baths, mild laxatives, and saline injections into the b
under the skin are useful remedies. Saline transfus
particularly efficacious in that they dilute the poison
lating in the blood, increase elimination, serve to mai
arterial pressure, and help to nourish the patient. Pe
tation should receive careful attention. In some cas

that raise the arterial pressure on the medulla, like strychnin, act beneficially; in others, vasodilators, like nitroglycerin, give better results. Drugs that directly depress the vomiting center are sometimes serviceable; chloral and bromids are the best of this class; morphin, as a rule, is badly borne. In neurotic subjects firmness tempered with kindliness and encouragement is essential to success. When the hysterical element is very pronounced, the Weir-Mitchell treatment can be recommended with considerable confidence.

When the measures which have been indicated, after a thorough trial prove futile, and the life of the patient is jeopardized by the incessant vomiting, there ought to be no question in the mind of the practitioner as to the advisability of terminating the pregnancy.

A curious form of vomiting is that which is known, for want of a better name, as nervous vomiting. It is not associated with any anatomic lesion of the stomach or with changes in the quantity or quality of the food, nor is it apparently of reflex character. In many instances it is evidently a symptom of hysteria. In this condition anti-emetics—cerium oxalate, menthol, hydrocyanic acid, and bismuth—are sometimes useful, but they more often fail. Suppositories of valerian, asafetida, and belladonna may prove efficacious. Lavage followed by the administration of silver nitrate (gr. $\frac{1}{4}$—0.016 gm.) often serves to allay the irritability of the gastric nerves. Hot compresses, sinapisms, or blisters over the epigastrium are indicated. A spray of ethyl chlorid along the spine and over the stomach has given good results. Galvanism with a current of low density, one pole (negative) over the back of the neck and the other (positive) within the stomach, may afford prompt relief. In many cases it is necessary to keep the patient perfectly quiet in the recumbent position, and to feed exclusively by the rectum. In intractable cases the Weir-Mitchell treatment should be given a thorough trial.

Vomiting dependent upon cancer of the stomach is sometimes controlled temporarily or lessened by anti-emetics. Cerium oxalate, ice-cold carbonated water, chloroform, hydrocyanic acid, and bismuth may be tried. Morphin hypodermically or by the rectum is also useful. When there is obstruction of the pylorus, lavage is of great service.

When the vomiting of ulcer is not relieved promptly by gastric sedatives, the patient should be kept at complete rest for a few days and nourished by rectal injections. Counter-irritation by means of small blisters over the epigastrium is useful. Inhalations of vinegar will often allay the nausea and vomiting resulting from etherization.

From the foregoing it is evident that while anti-em often exceedingly useful, they should be regarded palliative remedies or as adjuvants to more important measures. Anti-emetics may accomplish their purpos by acting on the center in the medulla, or indirectly ing irritability of the sensory nerve-endings in the To the first class belong:

Opium. Bromids. Hydrated Chlo

To the second class belong:

| | |
|---|---|
| Carbonated water. | Chloroform. |
| Ice. | Silver nitrate. |
| Bismuth subnitrate. | Menthol. |
| Hydrocyanic acid. | Lime-water. |
| Carbolic acid. | Ipecac (minute dos |
| Cocain. | Cerium oxalate. |

All these agents, with the exception of cerium ox considered under other headings.

### CERII OXALAS, U. S. P.

(Cerium Oxalate; $Ce_2(C_2O_4)_3+9H_2O$.)

Cerium oxalate is a white, odorless, and tasteless insoluble in water or alcohol. In doses of from 6 (0.3–1.0 gm.), preferably in the form of a dry powd very useful anti-emetic, acting mechanically, like bism trate, by coating the wall of the stomach. It is not from the gastro-intestinal tract and is non-toxic.

It has been chiefly employed against the *vomiting nancy;* but it is far more efficacious in allaying caused by *irritation of the mucous membrane of th* such as occurs in *gastritis*, *gastric ulcer*, and *gastric c* combination like the following is often effective:

℞ Cerii oxalatis,
Bismuthi subnitratis, aa ʒiss (6.0 gm.);
Pulveris ipecacuanhæ, gr. iij (0.2 gm.).—M
Ft. chartulæ No. xii.
Sig. one powder every hour.

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## GASTRIC ANTACIDS.

Gastric antacids are drugs employed to neutrali of the stomach-contents. Some drugs, like the and bicarbonate of sodium, have the power of less only the acidity of the stomach-contents, but also t

urine. Others, like ammonia and ammonium carbonate, serve as antacids in the stomach, but are eliminated in such a form that they have no influence on the reaction of the urine. Again, there are other drugs, like the vegetable salts of potassium and lithium, which have very little effect upon the acidity of the stomach, but, being eliminated as alkaline carbonates, render the urine less acid.

Gastric antacids are employed to neutralize the organic acids (lactic, butyric, and acetic) resulting from fermentation of the stomach-contents, and which excite eructations, heartburn, and gastralgia; to lessen the acidity in cases of hyperchlorhydria; and to antagonize poisons of an acid character.

It is generally believed that alkalies and alkaline carbonates, when taken before meals, stimulate gastric secretion, but the experiments of Reichmann and others have clearly shown that they produce no such effect. What efficacy they have in mild derangement of digestion is to be attributed to their power of neutralizing excessive acidity, dissolving tenacious mucus, and stimulating the stomach wall itself.

The most important antacids are:

| | |
|---|---|
| Sodium bicarbonate. | Magnesium carbonate. |
| Lime-water. | Calcium carbonate. |
| Magnesia. | Ammonia. |

## SODII BICARBONAS, U. S. P.

(Sodium bicarbonate; $NaHCO_3$.)

Sodium bicarbonate is a white, opaque, odorless powder, having a cooling, faintly alkaline taste. It is soluble in 12 parts of water and insoluble in alcohol. The dose is from 5–30 gr. (0.3–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Mistura Rhei et Sodæ, U. S. P. . . . . | 1–2 fl. dr. (2.0–8.0 c.c.). |
| Pulvis Effervescens Compositus (Seidlitz Powder), U. S. P. | |
| Trochisci Sodii Bicarbonatis, U. S. P., contain 2½ gr. (0.18 gm.) each. | |

**Therapeutics.**—Sodium bicarbonate is extensively used in diseases of the stomach to neutralize abnormal acids or hydrochloric acid when in excess. Given before meals in small doses (3–5 gr.—0.2–0.3 gm.), with some bitter stomachic, it often affords prompt relief in *mild forms of indigestion.* Given an hour or two after meals it allays the burning pain, eructations, and palpitation due to the *acids of fermentation.* Given at the height of digestion in large doses it relieves the painful

crises of *hyperchlorhydria*. Large doses of sodium bi are also useful in neutralizing the hydrochloric su encountered in *gastric ulcer*. In the *chronic gastro-catarrh of childhood*, characterized by capricious tympanites, eructations, troubled sleep, and hard mucous stools, sodium bicarbonate with a bitter an laxative often gives excellent results.

In daily doses of from 5–10 dr. (20.0–40.0 gm.) it employed successfully by Huchard and others in *diabetic coma*. In fully developed coma the drug s given intravenously in 3 to 5 per cent. acid soluti extent of one or two pints. The subcutaneous inj alkaline solutions should be avoided, as not rarely t sloughing.

Sodium bicarbonate is sometimes used externally a tive dressing in *superficial burns*. A 5 to 10 per c tion is an excellent remedy for *thrush*. It is emplo detergent in many washes designed for *chronic catarr tions of the nasopharynx*, and it is an ingredient of known Dobell's solution, which may be prescribed as

℞ Sodii bicarbonatis,
Sodii boratis, aā ʒj (4.0 gm.);
Phenolis, gr. xxx (2.0 gm.);
Glycerini, f℥j (30.0 c.c.);
Aquæ, Oij (1.0 L.).—M.

Sodium bicarbonate is incompatible with acids, salts, and alkaloids.

## LIQUOR CALCIS, U. S. P.

(Solution of Calcium Hydroxid; Lime-water.)

Lime-water is a saturated aqueous solution o hydroxid made by slaking lime with water. It is a cl less liquid, odorless, and having a saline, slightly ca It contains about 0.17 per cent. of calcium hydroxid. is from ½–2 fl. oz. (15.0–60.0 c.c.).

PREPARATIONS.

Linimentum Calcis, U. S. P. (lime liniment, Carron oil), co equal volumes of lime-water and linseed oil.
Lotio Hydrargyri Flava (yellow-wash), ½ dr. (2.0 gm.) of cor sublimate to 1 pint (0.5 L.) of lime-water.
Lotio Hydrargyri Nigra (black-wash), 1 dr. (4.0 gm.) of ca to 1 pint (0.5 L.) of lime-water.

**Therapeutics.**—In all conditions in which cow the chief article of diet, lime-water may be added to to prevent the formation in the stomach of hard cur

In the *diarrhea of children* and in *typhoid fever* it is especially useful when employed in this way. It is sometimes a useful remedy in *obstinate vomiting*, particularly when the latter is due to a high degree of acidity. In *chronic gastric catarrh* with excessive secretion of mucus, washing out the stomach with a weak solution of lime-water (1 : 10) before breakfast may be practised with great benefit.

Inhalations of atomized lime-water have been recommended for their solvent effect in *diphtheria* and *fibrinous bronchitis*. As an alkaline astringent lime-water is sometimes employed as an injection in *vaginitis*, *leucorrhea*, and *urethritis*. It may be used also as an injection in *seat-worms*, although it is inferior to an infusion of quassia. Carron oil is used as a soothing application for *burns* and *scalds*. It has received its name from being so extensively used by the workmen in the foundries at Carron, Scotland.

## OTHER ANTACIDS.

**Magnesia** (see p. 199).—Magnesia or magnesium oxid is official in two forms: light or calcined magnesia (*Magnesii Oxidum*) and heavy magnesia (*Magnesii Oxidum Ponderosum*). Both forms occur as white, insoluble powder, odorless, and having a slightly earthy taste. Heavy differs from light magnesia not only in its weight, but also in its not readily uniting with water to form a gelatinous hydroxid. The dose of either oxid is from 10–60 gr. (0.65–4.0 gm.).

Magnesia combines the usefulness of an antacid with that of a mild laxative. When there is constipation, it may be given instead of sodium bicarbonate or combined with that drug in all conditions in which an antacid is indicated. In the *diarrhea* of childhood, when there is unnatural acidity of the *primæ viæ*, it is an excellent laxative for removing sour, indigestible food. In *ulcer of the stomach* it may be advantageously combined with bismuth to control constipation.

**Magnesium Carbonate** (see p. 200).—This drug is used in the same doses and for the same purposes as magnesia.

**Calcium Carbonate** (see p. 377).—Calcium carbonate or chalk is an unirritating antacid and a feeble astringent. It is very useful in *diarrhea* with acidity of the *primæ viæ*, and it may be combined with bismuth subnitrate in the treatment of *gastric ulcer* when there is a marked tendency to looseness of the bowels. It is a chemical antidote to all the *poisonous acids*.

**Ammonia** (see p. 41).—Aromatic spirit of am doses of from 20–30 min. (1.2–2.0 c.c.), may be use of sodium bicarbonate to relieve the headache, h and pyrosis arising from acid fermentation in the

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## STOMACHICS.

Stomachics are drugs which sharpen the appetite mote the functional activity of the stomach. The portant members of this class of remedies are:

| | |
|---|---|
| Gentian. | Condurango. |
| Quassia. | Taraxacum. |
| Calumba. | Eupatorium. |
| Nux vomica. | Serpentaria. |
| Cinchona. | Cascarilla. |
| Chirata. | Wild cherry. |
| Chamomile. | Alcohol. |
| Hydrastis. | Orexin. |

All stomachics, with the exception of the last two i going list, contain a bitter principle. Taken by th bitters improve the appetite, and, by stimulating the nerve-endings, reflexly increase the salivary and gas tions. Being more or less irritant to the mucous m of the stomach and bowel, they also augment the movements. With the exception of cinchona and nu which have important constitutional actions, they exert no direct influence beyond the digestive organ effective, they should be taken in liquid form a s before eating. As a class, stomachics are useful in the stomach, in chronic gastritis when the mucous m is not very irritable, and in the early stages of canc are contraindicated in all conditions involving the s which there is marked irritability or hypersecretion.

### GENTIANA, U. S. P.

(Gentian.)

Gentian is the root of *Gentiana lutea*, a peren growing in the mountainous districts of Central and Europe. It contains an extremely bitter glucosi *picrin*, and *gentisic* or *gentianic acid*, which is inert.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Gentianæ Composita, U. S. P. (contains also bitter orange-peel and cardamom) | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Fluidextractum Gentianæ, U. S. P. . . . | 10–30 min. (0.6–2.0 c.c.). |
| Infusion Gentianæ Compositum . . . . | ½–2 fl. oz. (15.0–60.0 c.c.). |
| Extractum Gentianæ, U. S. P. . . . . | 2–5 gr. (0.13–0.3 gm.). |

**Therapeutics.**—Gentian is one of the most reliable of the bitter tonics. It is often of great value in the milder forms of *chronic indigestion*, in the *dyspepsia of phthisis*, and in the early stages of *cancer*. It is an excellent restorative in the *convalescence of acute fevers*. In indigestion it may be advantageously combined with an alkali, as in the following formula:

℞ Sodii bicarbonatis, ℥ij (8.0 gm.);
Infusi gentianæ compositi, f℥vj (180.0 c.c.).—M.
Sig. A tablespoonful before meals.

## QUASSIA, U. S. P.

Quassia is the wood of *Picrasma excelsa*, or of *Quassia amara*, a tree resembling the common ash, growing in the West Indies. It contains a bitter crystalline principle, *quassin*, but no tannic acid. The dose of quassin is from $\frac{1}{30}$–$\frac{1}{8}$ gr. (0.002–0.02 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Quassiæ, U. S. P. . . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Fluidextractum Quassiæ, U. S. P. . . | 10–20 min. (0.6–1.2 c.c.). |
| Extractum Quassiæ, U. S. P. . . . . | 1–3 gr. (0.06–1.2 gm.). |
| Infusion Quassiæ . . . . . | ½–2 fl. oz. (15.0–60.0 c.c.). |

**Therapeutics.**—As a stomachic, quassia may be used in the same class of cases as gentian.

The rectal injection of an infusion made by adding an ounce (31.0 gm.) of quassia chips to a pint (0.5 L.) of water is an efficient anthelmintic against *seat-worms* (*Oxyuris vermicularis*). To secure the best results the bowel should first be thoroughly cleansed by means of a simple soap-and-water enema.

As quassia does not contain tannic acid, its preparations are not incompatible with the salts of iron.

## CALUMBA, U. S. P.

(Columbo.)

Calumba is the root of *Jateorhiza palmata*, growing in Eastern Africa. It contains an alkaloid, *berberin*, a neutral principle, *columbin*, and *columbic acid*, all of which are bitter.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Calumbæ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Calumbæ, U. S. P. . . | 10–30 min. (0.6–2.0 c.c.). |
| Extractum Calumbæ . . . . . | 2–5 gr. (0.13–0.3 gm.). |
| Infusum Calumbæ . . . . . | ½–2 fl. oz. (15.0–60.0 c.c.). |

**Therapeutics.**—Calumba is a pure, unirritating b
may be prescribed with confidence in the various
in which stomachics are indicated. It may be comb
either acids or alkalies, and since it contains no tann
not form a black, unsightly mixture with the salts of
atony of the stomach it may be combined with nu
as in the following formula:

℞ Tincturæ capsici, ♏xvj (1.0 c.c.).
Tincturæ nucis vomicæ, ʒij (8.0 c.c.).
Tiincturæ calumbæ, q. s. ad ʒij (60.0 c.c.).—M.
Sig. A teaspoonful in water before meals.

## CHIRATA, U. S. P.

(Chiretta.)

Chirata is the entire plant of *Swertia chirayita*, g
the mountains of Northern India. It contains a bitt
line glucosid, *chiratin*, and *ophelic acid*, which is als

| Preparations. | Dose. |
|---|---|
| Fluidextractum Chiratæ, U. S. P. . . . | 10–30 min. (0.6–2.0 |
| Tinctura Chiratæ . . . . . | ½–1 fl. dr. (0.2–4.0 |
| Infusion Chiratæ . . . . . | ½–2 fl. oz. (15.0–60 |

**Therapeutics.**—In addition to its virtues as a bi
achic, chirata is supposed to possess decided cholago
erties. It is useful in those forms of indigestion
associated with so-called bilious attacks. Like qu
calumba, it is free from tannic acid; it is therefore r
patible with iron salts.

## ANTHEMIS, U. S. P.

(Chamomile.)

Chamomile is the flower-heads of *Anthemis nob*
ennial plant cultivated in Western Europe, and to sc
in the United States. It contains a volatile oil, a b
ciple, anthemin, and a small amount of tannin. C
is a mild stomachic and carminative, and is usually
in the form of an infusion (unofficial), of which
(30.0–60.0 c.c.) may be given.

## CONDURANGO.

Condurango is the bark of *Gonolobus Condurang*
ing vine indigenous to Ecuador. It contains tanni
or two bitter glucosids. It is usually employed i
of the fluid extract in doses of from 20–60 min. (1.2

**Therapeutics.**—Condurango was first recomn

Friedreich in 1874 as a curative remedy in cancer of the stomach. Later, Immermann and Riess reported cases in support of this view; but the testimony of numerous impartial observers has proved conclusively that the drug is without specific action. Notwithstanding the adverse opinion as to its curative power, nearly all who have used the drug agree that it often acts most beneficially on the concomitant catarrh, sharpening the appetite, lessening the pain, and promoting digestion. In some cases of *simple gastric catarrh* it is also efficacious. It may be prescribed with hydrochloric acid, as in the following formula:

℞ Acidi hydrochlorici diluti, fʒiss (6.0 c.c.);
Fluidextracti condurango,
Glycerini, aa fʒvj (22.5 c.c.);
Vini xerici, q. s. ad fℨiv (120.0 c.c.).—**M.**
**Sig.** A dessertspoonful in water after meals.

## TARAXACUM, U. S. P.

(Dandelion.)

Taraxacum is the root of *Taraxacum officinale*, growing in Europe and North America. It contains a crystalline bitter principle, *taraxacin*.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Taraxaci, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Extractum Taraxaci, U. S. P. | 5–30 gr. (0.3–2.0 gm.). |

**Therapeutics.**—Taraxacum is a mild stomachic, possessing feeble laxative properties.

## EUPATORIUM, U. S. P.

(Boneset; Thoroughwort.)

Eupatorium is the leaves and flowering tops of *Eupatorium perfoliatum*, a perennial plant growing in North America. It contains a bitter crystalline glucosid, *eupatorin*, tannin, and a volatile oil.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Eupatorii, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Infusion Eupatorii | 1–4 fl. oz. (30.0–120.0 c.c.). |

**Therapeutics.**—Eupatorium is employed as a stomachic and diaphoretic. Large doses excite vomiting and purging. The infusion, taken while hot, has long been a popular household remedy in *colds* and *muscular rheumatism*.

## SERPENTARIA, U. S. P.

(Virginia Snakeroot.)

Serpentaria is the rhizome and roots of *Aristolochia Serpentaria*, a perennial herb growing in the woods of the Eastern and Southern United States. It contains a bitter principle, *aristolochin*, a resin, tannin, and a volatile oil.

| Preparations. | Dose. |
|---|---|
| Tinctura Serpentariæ, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Serpentariæ, U. S. P. | 10–30 min. (0.6–2.0 c.c.). |
| Tinctura Cinchonæ Composita, U. S. P., contains 2 per cent. serpentaria | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Infusum Serpentariæ | ½–2 fl. oz. (15.0–60.0 c.c.). |

**Therapeutics.**—Serpentaria is believed to possess, in addition to its properties as a bitter tonic, the power of increasing the secretions, especially the sweat and the urine. Large doses are capable of causing nausea and vomiting. Serpentaria has been extensively employed as a stomachic in *atonic dyspepsia*, and, combined with more potent remedies, like nux vomica and cinchona, as a tonic in the convalescent stage of *acute fevers*. Garrod believes it to be a remedy of some power in *chronic rheumatism*.

## CASCARILLA.

Cascarilla is the bark of *Croton Eleuteria*, a shrub growing in the Bahama Islands. It contains a bitter principle, *cascarillin*, a volatile oil, a resin, and tannin.

| Preparations. | Dose. |
|---|---|
| Tinctura Cascarillæ | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Cascarillæ | 10–30 min. (0.6–2.0 c.c.). |
| Infusum Cascarillæ | ½–2 fl. oz. (15.0–60.0 c.c.). |
| Extractum Cascarillæ | 5–10 gr. (0.3–0.65 gm.). |

**Therapeutics.**—The action of cascarilla resembles somewhat that of serpentaria. For two centuries it was a favorite remedy in Germany and France in low fevers, diarrhea, and dysentery. At present it is rarely employed except as a bitter tonic. Mineral acids should not be given with the tincture or the fluid extract, since they precipitate the resin.

## PRUNUS VIRGINIANA, U. S. P.

(Wild Cherry.)

Prunus virginiana is the bark of *Prunus serotina*, a large tree growing in North America. It contains tannic acid, a

bitter principle, a non-crystalline glucoside—*amygdalin*, and a ferment—*emulsin*. Hydrocyanic acid is formed from the union of the last two constituents in the presence of water.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Pruni Virginianæ, U. S. P. . . | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Syrupus Pruni Virginianæ, U. S. P. . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Infusum Pruni Virginianæ, U. S. P. . . . . | ½–2 fl. oz. (15.0–60.0 c.c.). |

**Therapeutics.**—Wild cherry is a bitter tonic and a feeble nerve-sedative. It has been extensively employed in *phthisis* to allay irritable cough, its efficacy being attributed to the hydrocyanic acid. The amount of acid present, however, is so small that it can scarcely be of therapeutic value. It has also been used on the recommendation of Allbutt to combat the dyspnea and dyspepsia of *heart-disease*, but Allbutt himself admits that it is only in the very early stages of the disease that it exerts any decided influence. On account of its agreeable taste it is an excellent *vehicle* for unpalatable drugs.

## OREXIN.

(Phenyl-dihydro-chin-azolin.)

Orexin is a complex synthetic compound derived from chinolin. The tannate of orexin being freest from irritating properties is the best preparation for medicinal use. This salt appears as a yellowish-white, odorless powder, having a chalky taste. It is insoluble in water, but readily soluble in dilute hydrochloric acid. The dose is from 5–8 gr. (0.3–0.5 gm.), in capsules or tablets.

**Therapeutics.**—Orexin possesses the power to a certain extent of sharpening the appetite, stimulating the secretion of hydrochloric acid, and increasing the motor activity of the stomach. It is sometimes useful in restoring the appetite in the *early stages of phthisis*, in *chlorosis*, in *neurasthenia*, and in *convalescence* from acute diseases. Penzoldt and Hermanni have spoken very favorably of it in the *vomiting of pregnancy*. It is contraindicated in organic diseases of the stomach—cancer, ulcer, and gastritis—and in cases of hyperacidity.

It should be given two or three times a day, two hours before meals, and followed by a draft of half a glass of water.

## OTHER STOMACHICS.

**Alcohol** (see p. 43).—In small quantities dilute alcohol augments the flow of the gastric secretion, stimulates the peristaltic movements, and accelerates absorption. Large amounts retard digestion. In the form of light claret, dry

sherry, or whisky, it is often of service in *dyspepsia a with atony in the stomach*, particularly in old persons greatest caution is necessary in ordering it on accou danger of inducing the alcohol habit. All alcoholic tions are contraindicated when there is hyperesthes stomach or hypersecretion of acid.

**Nux Vomica** (see p. 141).—On account of its tonic properties nux vomica has a decided advant many other bitters. It not only sharpens the app increases secretion, but it probably has more effect other stomachic on the muscular movement of the and intestines. In *chronic indigestion*, when there a dences of decided irritation, it is often very efficient. *tation of the stomach* the result of atony it is our most drug, and should be given in full doses. It is also those cases of *marked flatulence*, common in elderl and dependent upon a lack of tone in the walls of the and bowel.

**Cinchona** (see p. 415).—Cinchona to a certain exte with nux vomica the advantage of being a general to as a stomachic. The compound tincture of cincho ham's tincture) is specially serviceable as a bitter to *convalescence of acute febrile diseases.* The indig sulting from overwork is often promptly relieved by nation of quinin in small doses with nux vomica, following formula:

℞. Quininæ sulphatis, gr. x (0.65 gm.);
Ferri lactatis, gr. xx (1.3 gm.);
Extracti nucis vomicæ, gr. v (0.3 gm.);
Pulveris ipecacuanhæ, gr. iij (0.2 gm.);
Oleoresinæ capsici, gr. ij (0.13 gm.).
Fiant pilulæ No. xx. Sig. One after meals.

**Hydrastis** (see p. 379).—Hydrastis is a useful b in *asthenic gastritis* with motor insufficiency. In a its virtues as a stomachic, it is an active stimulant to peristalsis. According to the researches of Ruthe of Cerna, it increases the flow of bile. The dru employed in the form of the fluid extract ($\frac{1}{2}$–1 fl. 4.0 c.c.) or of its chief alkaloid, hydrastin ($\frac{1}{6}$–$\frac{1}{2}$ 0.03 gm.).

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## DIGESTANTS.

Of the agents which take part in the process digestion the most important from the standpoint of peutist are hydrochloric acid, pepsin, and the enzymes

in the pancreatic secretion—trypsin, amylopsin, and steapsin. *Hydrochloric acid*, the natural acid of the stomach, is the most valuable of all digestants. It aids digestion not only directly, but also indirectly by stimulating the activities of the stomach, by preventing fermentation, and by assisting in the conversion of pepsinogen into the active pepsin and of labzymogen into the active labferment. As a remedy, hydrochloric acid is indicated in all conditions associated with inacidity or marked hypoacidity.

*Pepsin*, being absent from the gastric juice far less frequently than hydrochloric acid, is distinctly less useful as a remedy than the latter. It is of service, however, in conditions associated with apepsia or hypopepsia, such as the advanced stages of chronic gastritis, atrophy of the gastric glands, and carcinoma.

Of the *pancreatic enzymes*, trypsin digests proteids, amylopsin acts upon starches, and steapsin decomposes fats. Since these enzymes act best in alkaline or neutral solutions, and the contents of the stomach are naturally acid, it is argued by some authorities that artificial pancreatic extracts can possess no medicinal value; but it should be remembered that the contents of the stomach do not normally become acid until from ten to fifteen minutes after the ingestion of the food, that in indigestion the secretion of acid is often delayed, and that at least one of the constituents of the pancreatic secretion—trypsin, a more powerful proteolytic enzyme than pepsin—retains its effectiveness even in solutions that are somewhat acid.

The digestants in common use are:

| | | |
|---|---|---|
| Hydrochloric acid. | Pancreatin. | Pepsin. |
| Diastase. | Papayotin. | |

## ACIDUM HYDROCHLORICUM, U. S. P.

(Hydrochloric or Muriatic Acid; HCl.)

The official acid is a colorless, fuming liquid, of a pungent odor and an intensely acid taste. It contains 31.9 per cent. by weight of absolute hydrochloric acid. The dose is from 3–6 min. (0.2–0.4 c.c.) well diluted.

| Preparation. | Dose. |
|---|---|
| Acidum Hydrochloricum Dilutum, U. S. P., contains 10 per cent. of absolute hydrochloric acid | 5–20 min. (0.3–1.2 c.c.). |

**Toxicology.**—In overdoses, hydrochloric acid, li
mineral acids, acts as an irritant poison, causing inter
ing pain, vomiting and purging of mucous and bloo
rial, and collapse. The treatment consists in antagor
poison by soda, lime, chalk, soap, or other alkalies
tecting the stomach by demulcents; in combating
with diffusible stimulants, administered hypodermic
in relieving pain with morphin.

**Therapeutics.**—Hydrochloric acid is useful i
conditions of the stomach associated with inacidity
acidity, such as *chronic asthenic gastritis, atrophy of t
glands*, and *cancer of the stomach*. It is contraindica
though the normal acid is wanting, when there is any
of active inflammation. In the *continued fevers* it s
acts beneficially as a refrigerant and digestant, th
juice in these cases being generally deficient.

The strong acid is sometimes employed externa
*escharotic*.

**Administration.**—In indigestion the acid should
after meals, well diluted, care being taken to rinse th
thoroughly after its exhibition. It may be prescrib
bitter tonic, as in the following formula:

℞. Strychninæ sulphatis, gr. j (0.065 gm.
Acidi hydrochlorici diluti, f℥ij (8.0 c.c.);
Pepsini, ℥iss (6.0 gm.);
Tincturæ cardamomi compositæ, f℥ss (15.0 c.c.)
Aquæ, q. s. ad f℥iv (120.0 c.c.)
Sig. A teaspoonful in water after meals.

**Incompatibles.**—Hydrochloric acid is incompa
oxids, alkalies, carbonates, and hydrates, with many
salts, with albumin, and with some glucosids (glyc
In the above formula the hydrochloric acid sets free
carminic acid, but its formation is of no moment.

## PEPSINUM, U. S. P.

(Pepsin.)

Pepsin is a proteolytic ferment obtained from the
layer of fresh stomachs from healthy pigs. To be
official standard, it should be capable of digesti
favorable conditions, not less than 3000 times its ov
of freshly coagulated and disintegrated egg-albu
occurs as a yellowish-white, amorphous powder, or
translucent scales, having a faint odor and slightly
or saline taste. It is soluble in about 50 parts of w

so in water containing hydrochloric acid, and insoluble in alcohol. The dose is from 5–20 gr. (0.3–1.3 gm.).

**Therapeutics.**—Pepsin is sometimes of service in *chronic gastritis, atrophy of the gastric glands*, and *cancer*, but, as a rule, it is less efficacious than pancreatin, and both are inferior to dilute hydrochloric acid and bitters. Care should be taken to secure a reliable preparation. Pepsin should be given in full doses, with hydrochloric acid, after meals.

Most substances destroy or impair the proteolytic action of the drug, especially alcohol and alkalies.

## PANCREATINUM, U. S. P.

(Pancreatin.)

Pancreatin is a mixture of enzymes naturally existing in the pancreas of warm-blooded animals, and usually obtained from the fresh pancreas of the hog or ox. It appears as a yellowish-white, amorphous powder, having a faint odor and a meat-like taste. To be up to the official standard it should be capable of converting not less than 25 times its own weight of starch into substances soluble in water. The dose is from 5–20 gr. (0.3–1.3 gm.).

In faintly alkaline solution pancreatin has the power of emulsifying fats, and of converting proteids into diffusible peptones, and starches into sugars. In the presence of more than traces of mineral acids or large amounts of alkalies it soon becomes inert.

Pancreatin is extensively used for peptonizing milk and other foods, the process being as follows: Mix 5 gr. (0.3 gm.) of pancreatin and 20 gr. (1.3 gm.) of sodium bicarbonate in a small teacupful of cool water, and pour into a bottle containing a pint (0.5 L.) of fresh milk. Place the bottle in water so hot that the hand can be held in it without discomfort for a minute. As thoroughly digested milk has an unpleasant bitter taste, it is well to arrest digestion at the end of fifteen or twenty minutes by raising the milk for a few seconds to the boiling-point or by placing the bottle on ice.

Pancreatin is a useful aid to digestion in conditions associated with hypoacidity. It should be combined with sodium bicarbonate and given immediately before or during meals, so that its digestive powers can be exercised in the stomach before the contents become distinctly acid.

## DIASTASE.

Diastase is an amylolytic ferment obtained from malted grain—wheat, barley, oats, and rice. It is a yellowish-white

or brownish-yellow amorphous powder, tasteless, s water, but insoluble in alcohol; 1 part, under favor ditions, should convert 2000 parts of starch into de maltose. The dose is from 3–5 gr. (0.2–0.3 gm.).

Extracts of malt containing a variable quantity o are extensively employed. They are marketed in A thin liquid closely resembling beer; a thick brow liquid, containing much saccharine material; and a der, containing, in addition to diastase, dextrin, dex the salts of barley. These extracts are used as and as general tonics, but their value has been much

Chittenden finds that although diastase will act or alkaline solutions, it is most effective in solution slightly acid. It may be given before meals whe difficulty in digesting starchy foods.

### PAPAYOTIN.

(Papain; Papoid; Caroid.)

Papayotin is an albuminous ferment obtained fr *Papaya*, true papaw, or melon tree, growing in th It is a grayish-white amorphous powder, tasteless, an odor. It is quite soluble in water and glycerin, but in alcohol and ether. The dose is from 5–10 gr. (0.3

It is claimed for papayotin that it will conver into peptone, starch into maltose, and emulsify fats; although it will act in neutral or acid solutions, active in solutions of an alkaline reaction. Clinical with the preparations on the market indicates that t of doubtful value.

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## CARMINATIVES.

Carminatives are drugs that aid in the expulsi from the stomach or intestines. The origin of th somewhat obscure; it is probably derived from *carn* for wool—that is, a cleanser, but according to som ties it is derived from *carmen*, a charm. The gases the alimentary canal are swallowed with the food, a by the action of acid upon the carbonates contai saliva and food, or they are generated through fe or putrefaction of food. The most common ca ever, of abnormal accumulation of gas is fer

Excessive accumulations of flatus distend the viscus, excite spasm of its muscular fibers, and thus occasion distress or actual pain. Carminatives prove effective probably by relaxing the spasm, especially at the orifices, thus allowing the gas to escape. A form of distention occurs that is dependent upon atony of the walls of the stomach rather than upon an excessive accumulation of gas. In this condition carminatives are of little use. Although carminatives are chiefly valuable in expelling gas already formed, they also possess the power, to a very limited extent, of preventing the formation of flatus, for by quickening the gastric circulation and probably by increasing glandular activity, they play the part of stomachics, thus aiding digestion and lessening fermentation.

As a class, carminatives are of service also in allaying spasmodic contraction of the intestine caused by irritants other than flatus; thus they are effective in relieving colicky pains caused by irritant food or drugs, provided the irritation has not been sufficient to set up an inflammatory condition, in which case drugs of this class should be avoided. Carminatives are frequently combined with purgatives to prevent the griping pains that the latter are likely to induce when administered alone.

With the exception of alcohol, ether, and chloroform, carminatives are aromatics containing volatile oils as their chief active ingredients. The most important drugs of this class are:

| | | |
|---|---|---|
| Capsicum. | Ginger. | Fennel. |
| Pepper. | Cinnamon. | Coriander. |
| Peppermint. | Cajuput. | Asafetida. |
| Spearmint. | Anise. | Ether. |
| Cardamom. | Pimenta. | Compound spirit of ether |
| Cloves. | Sassafras. | |
| Nutmeg. | Caraway. | Chloroform. |
| | Turpentine. | |

Carminatives are usually administered by the mouth, but asafetida and turpentine are often exceedingly efficacious in removing intestinal flatus when they are administered in the form of enemata.

## CAPSICUM, U. S. P.

(Cayenne Pepper; African Pepper.)

Capsicum is the fruit of *Capsicum fastigiatum*, a small shrub growing in tropical America, in Asia, and in Africa. Its active principle is probably *capsaicin*, which appears in the form of

colorless crystals of an exceedingly pungent charact
dose of the powdered drug is from 1–3 gr. (0.06–0.2 g

| Preparations. | Dose. |
|---|---|
| Tinctura Capsici, U. S. P. . . . . | 10–20 min. (0.6–1. |
| Fluidextractum Capsici, U. S. P. . . . . | 1– 2 min. (0.06– |
| Oleoresina Capsici, U. S. P. . . . . | ¼– 1 min. (0.016 |
| Pilulæ Podophylli, Belladonnæ et Capsici, U. S. P. | 1– 2 pills. |
| Emplastrum Capsici, U. S. P. | |

**Physiologic Action and Therapeutics.**—E
applied, capsicum excites burning and redness, and in
trated form even vesication. When taken internally
doses, it produces a sense of warmth in the stomac
lates peristalsis, and aids in the expulsion of flatus.
doses produce severe irritation of the gastro-intestinal
genito-urinary tract, characterized by pain, vomiting,
and dysuria, with scanty, dark-colored urine. It is e
chiefly as a rubefacient, stomachic, and carminative.
form of a liniment it is sometimes an excellent remed
*neck*, *muscular rheumatism*, and *sprains*. Capsicum
is an efficient counterirritant in *pleurodynia* and *b*
Combined with cantharides (tincture of cantharides,
of capsicum, and alcohol, of each, ½ fl. oz.—15 c.c.)
quently employed as a stimulating lotion in *alopecia a*
gargle consisting of half an ounce (15 c.c.) of the tin
half a pint (235 c.c.) of water has been much used in
medicine in *sore throat* with relaxation of the uvula,
remedy is inferior to many others, and in severe inflan
it is calculated to do harm.

In the *gastric catarrh* following an alcoholic deba
characterized by fetid breath, a heavily furred tong
rexia, nausea, and a sinking sensation in the epigastr
tincture of capsicum in ten-drop doses is an invalu
machic. In the *flatulent dyspepsia* of the aged, especia
gourmands, it is a useful adjuvant to other stomachic
enne pepper in small doses may be employed to pro
absorption of certain drugs, notably of quinin. In
*constipation* due to deficient peristalsis a small amou
oleoresin may be added advantageously to a cathartic

## PIPER, U. S. P.

(Black Pepper.)

Black pepper is the unripe fruit of *Piper nigrum*, a
vine cultivated in the East Indies. It contains a c

neutral principle, *piperin*, an aromatic volatile oil, and a pungent resin.

| PREPARATIONS. | DOSE. |
|---|---|
| Piperina, U. S. P. | 1–5 gr. (0.06–0.3 gm.). |
| Oleoresina Piperis, U. S. P. | ½–2 min. (0.03–0.1 c.c.). |

**Therapeutics.**—Pepper is used chiefly as a condiment. Owing to its carminative properties, the oleoresin is sometimes added to cathartic pills. Piperin was at one time considered to be of value in malarial fever, but for lack of satisfactory evidence of its efficacy its use in this affection has been entirely abandoned.

## MENTHA PIPERITA, U. S. P.

(Peppermint.)

Peppermint is the leaves and tops of *Mentha piperita*, a perennial herb growing in wet places throughout the Temperate Zone. Its active principle is a greenish-yellow volatile oil, having a strong, characteristic odor and a pungent taste, followed by a sense of coolness when air is drawn into the mouth. When subjected to refrigeration, it yields the stearopten, *menthol* (p. 157).

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Menthæ Piperitæ, U. S. P. | 1–5 min. (0.06–0.3 c.c.). |
| Spiritus Menthæ Piperitæ, U. S. P. (10 per cent.) | 10–30 min. (0.6–2.0 c.c.). |
| Aqua Menthæ Piperitæ, U. S. P. | 1–4 fl. dr. (4.0–15.0 c.c.). |

The oil also enters into the official compound pills of rhubarb and vegetable cathartic pills.

**Therapeutics.**—Peppermint has long been employed as a carminative for relieving *flatulence* and *colic*, especially in young children. It is particularly useful in covering the taste of unpalatable medicines. The oil, or better still menthol, is sometimes effective, when applied locally, in relieving the milder forms of *neuralgia*.

## MENTHA VIRIDIS, U. S. P.

(Spearmint.)

Spearmint is the leaves and tops of *Mentha spicata*, a perennial herb growing wild in Europe and North America. Its active principle is a volatile oil.

| Preparations. | Dose. |
|---|---|
| Oleum Menthæ Viridis, U. S. P. | 1–5 min. (0.06- |
| Spiritus Menthæ Viridis, U. S. P. (10 per cent.) | 10–30 min. (0. |
| Aqua Menthæ Viridis, U. S. P. | 1–4 fl. dr. (4.0– |

Spearmint is the therapeutic equivalent of peppern

## CARDAMOMUM, U. S. P.

(Cardamom.)

Cardamom is the fruit of *Elettaria repens*, a perer cultivated in the mountainous regions of India. principle is a volatile oil, of which it contains abc cent.

| Preparations. | Dose. |
|---|---|
| Tinctura Cardamomi, U. S. P. | 1–2 fl. dr. (4.0–8.0 |
| Tinctura Cardamomi Composita, U. S. P. (contains also cinnamon, caraway, cochineal, and glycerin) | 1–2 fl. dr. (4.0–8.0 |
| Pulvis Aromaticus, U. S. P. (contains also ginger, cinnamon, and nutmeg) | 10–30 gr. (0.6–2.0 |

Cardamom also enters into the compound extrac cynth, compound tincture of gentian, tincture of rhu aromatic tincture of rhubarb.

**Therapeutics.**—It is used as an agreeable arc disguising the taste of other drugs, and as an adjuvant bitters in *flatulent dyspepsia*. When free acids are the compound tincture of cardamom, they separate cochineal insoluble carminic acid, but this incompatib no particular importance.

## CARYOPHYLLUS, U. S. P.

(Cloves.)

Cloves are the unexpanded flowers of *Eugenia* an evergreen indigenous to the East Indian Islands, vated to some extent in South America and Afri contain a yellow volatile oil of a characteristic oc pungent, spicy taste. The chief constituent of *Eugenol.*

| Preparations. | Dose.. |
|---|---|
| Oleum Caryophylli, U. S. P. | 1–5 min. (0.06–0 |
| Eugenol, U. S. P. | 1–5 min. (0.06–0 |

They also enter into compound tincture of lave matic tincture of rhubarb, and wine of opium.

**Therapeutics.**—Cloves are used as a counterirri anesthetic, and carminative. They are one of the ac

dients of the *spice-poultice*, which consists of powdered cloves, ginger, and cinnamon, of each, one or two teaspoonfuls; flour, a tablespoonful; whisky, sufficient to make a mass moist enough to spread on soft flannel. In this form they are a useful rubefacient for applying to the abdomen of children suffering from diarrhea. As a carminative, the oil is a useful addition to laxative pills, aiding materially in preventing *griping*. In *intestinal colic* brought on by exposure a drop or two of the oil in a teaspoonful of paregoric, repeated at short intervals, often gives speedy relief. The oil is also a popular remedy for *toothache*, being applied on a pledget of cotton to the cavity of the tooth.

## MYRISTICA, U. S. P.

(Nutmeg.)

Nutmeg is the seed of *Myristica fragrans*, an evergreen tree growing in the Molucca Islands and neighboring East India Islands. It contains a volatile oil, upon which its aromatic properties depend, and a fixed oil.

| Preparation. | Dose. |
|---|---|
| Oleum Myristicæ, U. S P. . . . . | 1–5 min. (0.06–0.3 c.c.). |

Nutmeg also enters into aromatic powder, compound tincture of lavender, aromatic tincture of rhubarb, aromatic spirit of ammonia, and troches of sodium bicarbonate.

In large doses nutmeg acts as a narcotic poison, producing headache, vertigo, delirium, stupor, coma, and, finally, death from respiratory paralysis. Like cloves, it is employed as a carminative and a local anodyne.

## ZINGIBER, U. S. P.

(Ginger.)

The rhizome of *Zingiber officinale*, a perennial herb growing in tropical countries. It contains a volatile oil having the odor of ginger, and a viscid resinous principle having a hot, pungent taste.

| Preparations. | Dose. |
|---|---|
| Tinctura Zingiberis, U. S. P. . . . . | 20–60 min. (1.2–4.0 c.c.). |
| Fluidextractum Zingiberis, U. S. P. . . | 10–30 min. (0.6–2.0 c.c.). |
| Syrupus Zingiberis, U. S. P. . . . . | ½–4 fl. dr. (2.0–15.0 c.c.). |
| Oleoresina Zingiberis, U. S. P. . . . . | ½–2 min. (0.03–0.1 c.c.). |

Ginger also enters into compound powder of rhubarb and aromatic powder.

**Therapeutics.**—It is employed as a carminative and as a flavoring agent.

## CINNAMOMUM.

(Cinnamon.)

The United States Pharmacopœia recognizes 2 va
cinnamon: *Cinnamomum Saigonicum* (Saigon cinn
species cultivated in the neighborhood of Saigon, the
French Cochin-China, and *Cinnamomum Zeylanicum*
cinnamon). Cinnamon contains a volatile oil and
amount of tannin. The oil consists chiefly of *cinna*
*hyd*, which on exposure is oxidized into resin and
*acid*. The official oil is distilled from Cassia or Chi
namon.

| Preparations. | Dose. |
|---|---|
| Oleum Cinnamomi, U. S. P. . . . . | 1–5 min. (0.06–0.3 |
| Cinnaldehydum, U. S. P. . . . . | ½–3 min. (0.03–0.2 |
| Spiritus Cinnamomi, U. S. P. (10 per cent. of oil) . . . . . | 10–30 min. (0.6–2.0 |
| Tinctura Cinnamomi, U. S. P. (10 per cent. of cinnamon) . . . . . | ½–2 fl. dr. (2.0–8.0 |
| Aqua Cinnamomi, U. S. P. . . . . | ½–1 fl. oz. (15.0–30 |

Cinnamon also enters into aromatic fluidextract, in
digitalis, compound tincture of cardamom, compound
of lavender, compound tincture of gambir, wine of op
aromatic powder.

**Therapeutics.**—Cinnamon possesses carminat
feebly astringent properties. The oil is an active a
Cinnamon-water is an agreeable vehicle for *diarrhea*
The oil has been used to some extent as an antiseptic
cal dressings. Very favorable results have been repo
the use of cinnamon in *influenza*.

Cinnamic acid and its sodium salt have been highly
by Landerer, Heusser, and others in the treatment of
*losis*. It is claimed that intravenous injections of so
namate (⅛ gr.—0.008 gm.—every forty-eight hours,
increased to ⅓ gr.—0.02 gm.) induce a marked hyper
tosis and favor the formation of cicatricial tissue ar
tuberculous area. A careful review of the report
however, does not warrant the belief that this method
ment is any more effective than other methods that a
painful.

## OLEUM CAJUPUTI, U. S. P.

(Oil of Cajuput.)

Oil of cajuput is a thin, bluish-green, volatile oil
from the leaves of *Melaleuca Leucadendron*, a small t
ing in the East India Islands. It has a camphorace

and an aromatic, bitter taste. The dose is from 2–10 min. (0.12–0.6 c.c.) in emulsion, in capsules, or on sugar.

**Therapeutics.**—Cajuput oil is one of the most efficient of the carminatives. It is an excellent adjunct to other remedies in the *flatulent dyspepsia* of the aged. Combined with opium it is undoubtedly useful in *diarrhea* with choleraic symptoms. It has been used also as a rubefacient in muscular rheumatism and as a parasiticide in ringworm.

## ANISUM, U. S. P.

(Anise.)

Anise is the fruit of *Pimpinella Anisum*, a small plant cultivated in Southern Europe and North America. It contains a volatile oil having the characteristic odor of anise and a sweetish, aromatic taste.

| Preparations. | Dose. |
|---|---|
| Oleum Anisi, U. S. P. | 2–5 min. (0.12–0.3 c.c.). |
| Aqua Anisi, U. S. P. | 2–8 fl. dr. (8.0–30.0 c.c.). |
| Spiritus Anisi, U. S. P. (10 per cent. of oil) | 1–2 fl. dr. (4.0–8.0 c.c.). |

Anise also enters into camphorated tincture of opium, compound spirit of orange, aromatic elixir, compound syrup of sarsaparilla, and troches of opium and licorice.

**Therapeutics.**—Although anise is an effective carminative, it is used chiefly as a flavoring agent.

## PIMENTA, U. S. P.

(Allspice.)

Allspice is the nearly ripe fruit of *Pimenta officinalis*, an evergreen tree growing in the West Indies and South America. It contains a volatile oil, the active constituent of which is *Eugenol*.

| Preparation. | Dose. |
|---|---|
| Oleum Pimentæ, U. S. P. | 1–5 min. (0.06–0.3 c.c.). |

Oil of pimenta enters into spirit of myrcia, or bay-rum.

## SASSAFRAS.

Sassafras is official as the bark (*sassafras*) and as the pith (*sassafras medulla*) of *Sassafras variifolium*, a shrub or tree growing in Eastern North America. It contains a fragrant, aromatic, volatile oil and a fair amount of tannin (6 per cent.).

| Preparations. | Dose. |
|---|---|
| Oleum Sassafras, U. S. P. | 1–5 min. (0.06–0.3 |
| Mucilago Sassafras Medullæ, U. S. P. (2 per cent.) | 1–8 fl. dr. (4.0–30.0 |

Sassafras also enters into compound fluid extract of
rilla, compound syrup of sarsaparilla, and troches of c

## CARUM, U. S. P.

(Caraway.)

Caraway is the fruit of *Carum Carvi*, an herb indig
Asia, and cultivated in Europe and North Amer
active ingredient is a volatile oil.

| Preparation. | Dose. |
|---|---|
| Oleum Cari, U. S. P. | 1–5 min. (0.06–0.3 |

Caraway also enters into compound tincture of ca
and compound spirit of juniper.

## FŒNICULUM, U. S. P.

(Fennel.)

Fennel is the fruit of *Fœniculum vulgare*, grown
Southern Europe. It contains an aromatic volatile o

| Preparations. | Dose. |
|---|---|
| Oleum Fœniculi, U. S. P. | 1–5 min. (0.06–0.3 |
| Aqua Fœniculi, U. S. P. | 1–8 fl. dr. (4.0–30.0 |

Fennel also enters into compound licorice powd
pound spirit of juniper, and compound infusion of se

## CORIANDRUM, U. S. P.

(Coriander.)

Coriander is the fruit of *Coriandrum sativum*, an he
in all parts of Europe and the United States. It c
volatile oil.

| Preparation. | Dose. |
|---|---|
| Oleum Coriandri, U. S. P. | 1–5 min. (0.06–0.3 |

Coriander also enters into confection of senna,
senna, and compound spirit of orange.

The carminative properties of *asafetida*, *ether*, *compound spirit of ether*, *chloroform*, and *turpentine* are discussed elsewhere in this volume.

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## CATHARTICS.

Cathartics are drugs that are employed in medicine to cause evacuation of the bowels. They may act by irritating the intestines or by augmenting the fluid of the feces. In the first instance intestinal peristalsis is increased directly, and in the second instance it is increased indirectly by distention of the bowel. *Vegetable cathartics* (castor oil, rhubarb, aloes, jalap, podophyllum, etc.), *calomel*, and *phenolphthalein* act through their irritant properties. These drugs also render the stools more or less watery; but this effect is to be ascribed to the rapid evacuation of the intestinal contents and the escape of much liquid that would otherwise be reabsorbed, or, in case the action of the drug has been more or less violent, to the development of a true inflammatory process with serous exudation.

*Saline cathartics* do not irritate the bowel unless given in very large doses. On the other hand, they retard the absorption of liquids (if in isotonic or hypotonic solution) and withdraw water from the blood (if in hypertonic solution), and thus, by distending the bowel, stimulate peristaltic movements. Only salts that are difficult of absorption, like the sulphates, phosphates, and tartrates, have a purgative effect. Magnesium sulphate is especially active in this respect, as neither its basic nor its acid ion is readily absorbed. Nitrates, chlorides, acetates, and other rapidly absorbed salts induce diuresis rather than purgation because they draw water from the tissues into the blood, and so increase the capillary pressure in the kidneys.

It has long been accepted as a fact that certain cathartics, like mercury and sodium phosphate, stimulate the liver and increase the secretion of bile, and, in consequence, these drugs have been known as *cholagogues* or *cholagogue purgatives*. Not much evidence, however, can be adduced in support of this assumption. It is true that the group of symptoms to which the term "biliousness" is applied often disappears as by magic after the administration of a full dose of calomel, but there is no proof that these symptoms are due to inactivity of the liver; on the contrary, there is much to support the view that they are due solely to some derangement of the stomach and intestines. Nor can the dark green color of the stools that is observed after the administration of certain cathartics be claimed as an evidence

of increased secretion, for it is doubtless due, in larg
the rapid flow of bile into the lower bowel and i
from decomposition and reabsorption. Rutherford li
common bile-duct, inserted a cannula into it, and th
the effect that the injection of certain drugs into t
enum had upon the flow of bile. From his experi
concluded that the following drugs increase the sec
bile:

| | |
|---|---|
| Podophyllin. | Jalap. |
| Aloes. | Sodium sulphate. |
| Rhubarb. | Sodium phosphat |
| Colchicum. | Rochelle salt. |
| Iridin. | Euonymin. |
| Colocynth. | Ipecacuanha. |

Corrosive sublimate.

Unfortunately, Rutherford's experiments were to
number and his results too often contradictory to
conclusions, and, moreover, recent investigations,
those of Stadelmann and Pfaff, have failed complete
firm the facts embodied in Rutherford's report.
body known to have a decided cholagogue action is
although salicylic acid and its salts also promote t
secretion to a slight extent.

The colicky pains induced by cathartics are pro
result of scybala interrupting the regular peristal
ments, and throwing the muscular fibers into viole
This view is confirmed by the experiments of Cash, v
that the slightest weight sufficed to check the onwa
ment of the substance in the intestine and to set up
tions of a painful character.

**Classification.**—Cathartics have been variously
according to the intensity of their action and the ch
the stools they produce. Since the effect of any c
dependent, to a great extent, upon the dose, the ti
ministration, the susceptibility of the patient, and th
the bowel, it is evident that a classification based up
ologic action must necessarily be an imperfect one;
less, when its limitations are fully recognized, such
cation is the most convenient one that can be
Cathartics, therefore, may be divided into laxatives, p
drastics, and hydragogues.

**Laxatives** are the least irritating of all the cath
ordinarily produce stools that are nearly normal in a
and consistence. Many articles of food, such as

bran bread, figs, prunes, apples, etc., serve as laxatives. The most important drugs belonging to this class are:

| | |
|---|---|
| Manna. | Cassia fistula. |
| Tamarind. | Euonymus. |
| Cascara sagrada. | Butternut. |
| Frangula. | Iris. |
| Magnesia. | Leptandra. |
| Sulphur. | Ox-gall. |

**Purgatives** are more powerful than laxatives, and usually produce one or more copious stools of a semiliquid consistence. The difference between the action of a laxative and that of a purgative is mainly one of degree: laxatives in large doses act as purgatives, and the latter in small doses act as laxatives. The most important purgatives are:

| | |
|---|---|
| Aloes. | Castor oil. |
| Rhubarb. | Calomel. |
| Senna. | Blue mass. |

**Drastics** have a violent action, and in overdoses produce the symptoms of acute enteritis. The most important are:

| | |
|---|---|
| Croton oil. | Podophyllum. |
| Colocynth. | Jalap. |
| Gamboge. | Elaterium. |
| Scammony. | Bryonia. |

**Hydragogues** produce large watery stools and give rise to but slight irritation. The principal ones are:

| | |
|---|---|
| Magnesium sulphate. | Potassium and sodium tartrate. |
| Sodium sulphate. | Sodium phosphate. |
| Magnesium citrate. | |

Some of the drastics, especially jalap, elaterium, and bryonia, in appropriate doses, are efficient hydragogues.

**Indications.**—*To Relieve Constipation.*—In *simple acute constipation* the prompt administration of a cathartic or the employment of an enema is nearly always advisable. In *chronic constipation the result of atony of the bowel* a resort should first be had to dietetic and hygienic measures, but, these failing, a laxative should be prescribed. As a rule, the

use of laxatives in these cases, even when habitual
baneful than the persistent constipation. Indeed, mi
table cathartics are often taken for indefinite periods
producing harmful effects. Brodie speaks of a man,
six years of age, who for threescore years took an al
every night.

*To Remove Irritants from the Bowel.*—In the begin
*acute diarrhea* it is generally well to administer a
castor oil, calomel, or Epsom salts, to rid the bowel
gested material, ptomains, and micro-organisms. In *p*
if the irritant has escaped from the stomach into the
purgative should take the place of an emetic.

*To Promote Absorption.*—Hydragogue cathartics, e
the salines, are often useful in *cardiac* and *renal dropsy*
not only remove directly from the body a certain am
fluid, but, by depleting the blood, promote the reabsor
the lymph that has accumulated in the tissues.

In *serous effusions* of an inflammatory character, suc
met with in *pleurisy* and *pericarditis*, cathartics ar
serviceable.

Certain drugs, such as digitalis and quinin, may pr
fective until the bowel has been unloaded and th
system depleted by the administration of a brisk cath

*To Remove Excrementitious Substances from the Bl*
*uremia* and *puerperal eclampsia* the administration of c
is a measure of the greatest value in securing the eli
of noxious material.

*To Relieve Cerebral Congestion.*—In *acute cerebral c*
and *mania* cathartics serve a useful purpose, s
inviting blood to the bowel, they tend to deplete t
In *cerebral hemorrhage*, also, they may do good by
ing further extravasation.

**Administration.**—Cathartics are most commonl
istered by the mouth. The salines are given in solu
vegetable preparations, most conveniently in the form
In chronic constipation a combination of several drug
gives rise to less pain and is more effective than a sin
A little of the extract of belladonna or a drop of o
aromatic oils is frequently employed as an adjuvant t
griping. When atony of the bowel is pronounced, e
nux vomica or physostigma may be added to th
enhance its stimulating effect. The time of adminis
a factor to be considered in prescribing any cathart
of the vegetable cathartics are likely to cause less
nience if administered after the evening meal or on

bed. Salines or saline mineral waters act more promptly and powerfully when given before breakfast.

Very often an enema is the most satisfactory means of unloading the bowel. A metal syringe with a piston or one made entirely of soft rubber may be employed for the purpose. The syringe should be filled with the fluid; all the air should be expelled from it before the nozzle is inserted. The patient should lie near the edge of the bed, on the left side, with the knees drawn up. A towel should be held against the anus on withdrawing the nozzle, so that the fluid may be retained in the bowel for several minutes. An enema may act by distending the bowel (mechanically), by softening the intestinal contents, or by directly irritating the intestinal walls.

A simple enema is one composed of cool or tepid water or of soap and water. For an infant, 1 or 2 ounces (30.0–60.0 c.c.) may be employed; for a child, from 4 to 8 ounces (120.0–240.0 c.c.); and for an adult, from 1 to 2 pints (0.5–1.0 L.). The injection may be made more powerful by adding, in the case of an adult, 1 ounce (30.0 c.c.) of castor oil, ½ ounce (15.0 c.c.) of molasses, or from 1 to 2 drams (4.0–8.0 c.c.) of turpentine. The following enema, official in the British Pharmacopeia, is very useful:

| | |
|---|---|
| Magnesium sulphate | 1 ounce (30.0 c.c.). |
| Olive oil | 1 ounce (30.0 c.c.). |
| Mucilage of starch | 15 ounces (445.0 c.c.). |

A small enema of glycerin (1–2 drams—4.0–8.0 c.c.) is generally very efficacious. In cases of fecal impaction an enema of warm salad or linseed oil (6–8 ounces—180.0–240.0 c.c.) or an infusion of ox-gall often proves serviceable. In some cases of chronic indigestion with constipation flushing out the lower bowel with from 6 to 8 pints (3.0–4.0 L.) of tepid water, two or three times a week, by means of a soft-rubber tube passed well up into the sigmoid flexure, is followed by excellent results.

It is well to remember that bulky enemata containing hard soap are occasionally followed, after the lapse of a few hours, by a scarlatiniform, measly, or urticarial rash.

The introduction into the rectum of suppositories made of yellow soap, glycerin, or gluten is another means frequently employed to unload the bowel.

It has been shown that certain drugs—aloin, colocynthin, and cathartic acid—will produce catharsis when given hypodermically. The irritation caused by the injections of these substances, however, is so severe as to forbid the employment of this method of administration except under unusual circumstances.

## MANNA, U. S. P.

Manna is a concrete saccharine exudation from *Ornus*, a small tree a native of Sicily and other Medite islands. It occurs in the form of yellowish-white or br white three-edged pieces or fragments, having a cr structure, a honey-like odor, and a sweetish, faintl taste. Its chief constituent is *mannite* (50–80 per sweet crystalline principle soluble in water. In doses ½ to 2 ounces (15.0–60.0 gm.) manna acts as a mild It is usually given in combination with other cathartic

| PREPARATION. | DOSE. |
|---|---|
| Infusum Sennæ Compositum, U. S. P. (Black Draft) | 1–4 fl. oz. (30.0–1 |

## TAMARINDUS, U. S. P.

(Tamarind.)

Tamarind is the preserved pulp of the fruit of *Tam indica*, a large tree indigenous to Africa, and culti the West Indies. It is a gentle laxative, about equal i to the fig and prune. Its aperient properties are du to the potassium salts of tartaric, citric, malic, and acet of which it contains from 8 to 12 per cent. The dose 1 to 8 drams (4.0–30.0 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Confectio Sennæ, U. S. P. | 1–2 dr. (4.0–8.0 g |

## RHAMNUS PURSHIANA, U. S. P.

(Cascara Sagrada; Chittem Bark.)

Cascara sagrada is the bark of *Rhamnus Purshiana*, tree growing in Northern California, Oregon, and Was It is allied to *Rhamnus Frangula* (buckthorn) and t *nus cathartica* (buckthorn). It contains *emodin* an anthracene derivatives,[1] and so is allied chemically to rhubarb, aloes, and senna.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Rhamni Purshianæ, U. S. P. | 10–30 min. (0.6–2 |
| Fluidextractum Rhamni Purshianæ Aromaticum, U. S. P. | 10–30 min. (0.6–2. |
| Extractum Rhamni Purshianæ, U. S. P. | 2–8 gr. (1.3–0.5 g |

[1] These bodies are substitution products of anthraquinone. Amon *emodin*, *cathartin*, *frangulin*, *aloin*, and *chrysophanic acid*. Recently thetic anthracene compounds have been put upon the market as sub the crude drugs: purgatin, exodin, and purgen (phenolphthalein).

**Therapeutics.**—Cascara sagrada is used exclusively as a tonic laxative, and in *habitual constipation* due to torpor of the bowel it is a most reliable remedy. It possesses a great advantage over many cathartics in not readily losing its effect when frequently taken; indeed, in many cases the dose can be diminished gradually and still give satisfactory results.

In most cases a single dose at bedtime will afford relief, but sometimes small doses (10 drops) after each meal are more effective. On account of its unpleasant bitter taste the fluid extract is best given in some aromatic syrup or cordial, as in the following formula:

℞ Fluidextracti rhamni purshianæ,
Fluidextracti sarsaparillæ compositi.
Glycerini, āā f℥j (30.0 c.c.).—M.
Dose: A teaspoonful or more.

## FRANGULA, U. S. P.

(Buckthorn.)

Frangula is the bark of *Rhamnus Frangula*, a shrub growing in Europe and Northern Asia. When fresh, it is a powerful irritant, but its action is modified by age, and therefore the Pharmacopeia specifies that it should be at least one year old before being used. It contains a crystalline glucosid, *frangulin*.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Frangulæ, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |

Frangula has an action not unlike that of senna. In this country it has been almost entirely displaced by *Rhamnus Purshiana*.

## MAGNESII OXIDUM, U. S. P.

(Light Magnesia; Calcined Magnesia; Magnesium Oxid; MgO.)

Light magnesia is a white, very light, odorless powder, having an earthy taste. It is almost insoluble in water, insoluble in alcohol, but soluble in dilute acids. The dose as a laxative is from 30–60 gr. (2.0–4.0 gm.).

| Preparations. | Dose. |
|---|---|
| Pulvis Rhei Compositus, U. S. P. (65 per cent.) | 30–60 gr. (2.0–4.0 gm.). |
| Ferri Hydroxidum cum Magnesii Oxido, U. S. P. | 2–4 fl. oz. (60.0–120.0 c.c.). |

**Therapeutics.**—Magnesia is partly converted by the acids of the stomach into soluble salts that have a laxative

action; it therefore combines the properties of an ant
those of a mild aperient. It is not a suitable drug for
use in simple chronic constipation, since, when not th
acidified, there is a possibility of its forming intestina
tions. It may replace sodium bicarbonate, however,
*cessive acidity exists with constipation.* In *ulcer of th*
it may be combined with bismuth subnitrate to cor
stipation. It may be given with syrup of rhubarb in
stages of *acute diarrhea* to rid the bowel of any s
material that may give rise to irritation. It is also ar
in *arsenic poisoning*, and is doubly efficient in the
ferric hydrate with magnesia.

## MAGNESII OXIDUM PONDEROSUM, U.

(Heavy Magnesia; Heavy Calcined Magnesia; Magnesium Oxid

Heavy magnesia is three and a half times heavier t
magnesia, and, unlike the latter, does not readily u
water to form a gelatinous hydrate. It has the sam
ties and uses as light magnesia.

## MAGNESII CARBONAS, U. S. P.

(Magnesium Carbonate; $(MgCO_3)_4.Mg(OH)_2+5H_2O$.)

Magnesium carbonate occurs in light, white, friab
or as a light white powder, free from odor, and
slightly earthy taste. It is almost insoluble in wat
ble in alcohol, but soluble in dilute acids with active
cence. The dose as a laxative is from 20–60 gr. (1.3-

Magnesium carbonate has the same therapeutic
magnesia, but when there is much acid in the stor
likely to cause unpleasant eructations of gas.

## SULPHUR.

(S.)

The United States Pharmacopeia recognizes 3
sulphur:

Sulphur Sublimatum.
Sulphur Lotum.
Sulphur Præcipitatum.

**Sublimed sulphur** (flowers of sulphur) is a fin
powder having a slightly characteristic odor and
acid taste. It is insoluble in water, but partially s
absolute alcohol, ether, chloroform, boiling solution

line hydrates, oil of turpentine, and many other oils. It usually contains small quantities of sulphuric acid, arsenic sulphid, and other impurities. The dose is from 10 to 120 gr. (0.65–8.0 gm.).

**Washed sulphur** is prepared by digesting for three days sublimed sulphur in weak ammonia water.

There are 2 official preparations of washed sulphur:

Unguentum Sulphuris (15 per cent.).
Pulvis Glycyrrhizæ Compositus (8 per cent.).

**Precipitated sulphur** (milk of sulphur) is a fine, almost white powder, without odor or taste. It is prepared by precipitating calcium sulphid with diluted hydrochloric acid. The dose is from 10 to 120 gr. (0.65–8.0 gm.).

**Physiologic Action and Therapeutics.**—When sulphur is taken internally, a considerable portion passes out unchanged; some, however, is converted by the alkaline secretions of the bowel into hydrogen sulphid and other sulphids. It is to the latter compounds that sulphur owes its active properties. They are the cause of the mild catharsis and the offensive flatus that follow the ingestion of sulphur. Being partially absorbed, they escape from the lungs and skin as sulphids, and from the kidneys as sulphates.

Sulphur may be employed as a laxative when a very mild action is desirable, as in *pregnancy*, *hemorrhoids*, *fissure of the anus*, and *prolapse of the bowel*. The dose as a laxative is from 1 to 2 dr. (4.0–8.0 gm.) in syrup or molasses. Sulphur has a long-standing reputation, both as an internal remedy and as a local application, in *chronic articular rheumatism*. Externally, it is much used as a stimulant and parasiticide in certain chronic diseases of the skin. It is often useful in *eczema*, *comedo*, *acne*, and *psoriasis*, and it may be prescribed in an ointment having the strength of from ½ to 2 dr. (2.0–8.0 gm.) to the ounce (30.0 gm.). It is absolutely contraindicated in the acute stages of any skin disease. In parasitic diseases, like *scabies* and *ringworm*, it is a reliable remedy.

## CASSIA FISTULA, U. S. P.

(Purging Cassia.)

Purging cassia is the fruit of *Cassia Fistula*, a tree extensively cultivated in all tropical countries. It contains about 60 per cent. of sugar, with albuminoids and organic salts. The dose is from 1–4 dr. (4.0–15.0 gm.). It has a mild laxative

action, but on account of its tendency to cause grip prescribed only in combination with other remedies

| Preparation. | Dose. |
|---|---|
| Confectio Sennæ, U. S. P. (16 per cent.) . . | 1–2 dr. (4.0–8.0 gm |

## EUONYMUS, U. S. P.

(Wahoo.)

Euonymus is the bark of the root of *Euonymus pureus*, growing in Eastern North America. It c soluble, amorphous glucosid, *euonymin*, which affects culation like digitalis. The dose of the latter is fro (0.03–0.2 gm.).

| Preparations. | Dose. |
|---|---|
| Extractum Euonymi, U. S. P. . . . . | 1–5 gr. (0.065–0. |
| Fluidextractum Euonymi, U. S. P. . . . . | 5–20 min. (0.3–1. |

The cathartic action of euonymus resembles that phyllum, although it is less powerful. It has been with cholagogue as well as laxative properties, but it undoubtedly hastens the elimination of bile and pre reabsorption of that secretion, there is not sufficient warrant the belief that the drug actually increases tional activity of the liver.

Combined with other cathartics, euonymus is a usef in the condition popularly known as "biliousness."

## JUGLANS.

(Butternut.)

Butternut is the bark of the root of *Juglans cinere* tree belonging to the walnut family, and growing America.

| Preparation. | Dose. |
|---|---|
| Extractum Juglandis . . . . . | 5–10 gr. (0.3–0.6 |

Its action somewhat resembles that of rhubarb, fo has been used as a substitute. It is seldom employ present day.

## IRIS.

(Blue Flag.)

Blue flag is the rhizome and roots of *Iris versicolo* nial herb growing in the swampy places of North It contains an acrid resin and possibly an amorphou

| Preparations. | Dose. |
|---|---|
| Fluidextractum Iridis | 10–20 min. (0.6–1.3 c.c.). |
| Extractum Iridis | 1–4 gr. (0.06–0.25 gm.). |

Iris in sufficient dose produces active catharsis with bilious stools. Its action resembles that of podophyllum, though milder. At one time held in high esteem, it has at present fallen into disuse.

## LEPTANDRA, U. S. P.

(Culver's Root.)

The rhizome and roots of *Veronica virginica*, a perennial herb growing in the eastern portion of the United States. It contains a crystalline glucosid, *leptandrin*, which is to be distinguished from an impure resin also known as leptandrin.

| Preparations. | Dose. |
|---|---|
| Fluidextractum Leptandræ, U. S. P. | 10–60 min. (0.6–4.0 c.c.). |
| Extractum Leptandræ, U. S. P. | 1–5 gr. (0.06–0.3 gm.). |
| Pilulæ Catharticæ Vegetabiles, U. S. P. | 1–3 pills. |

In the fresh state leptandra is a violent gastro-intestinal irritant. Preparations made of the dried root have a laxative or purgative effect, according to the dose, but they are somewhat uncertain in their action. Leptandra has been largely superseded by more reliable remedies.

## FEL BOVIS, U. S. P.

(Oxgall.)

Purified oxgall (*Fel Bovis Purificatum*, U. S. P.) only is used in medicine. It is prepared by evaporating to a pilular consistence fresh oxgall that has been subjected for several days to the action of alcohol. It is a yellowish-green, soft solid, having a peculiar odor and a partly sweet and partly bitter taste. The dose is from 5–15 gr. (0.3–1.0 gm.).

**Physiologic Action and Therapeutics.**—Bile is an active cholagogue and an uncertain laxative. That it is a true hepatic stimulant, increasing both the liquid and the solids secreted by the liver, has been amply confirmed by Rosenberg, Stadelmann, Joslin, and other investigators who have experimented on both animals and human beings with permanent biliary fistulæ. When bile is not present in the intestines, the digestion of fat is materially aided by the administration of oxgall by the mouth. In the test-tube bile suspends peptic digestion by precipitating the soluble proteids (proteoses and peptones) and probably also pepsin; but in the

living subject, when the fat is excessive in the stools, it has been shown that it promotes the digestion of proteid food.

Careful bacteriologic studies do not indicate that bile possesses the pronounced antiseptic properties that are generally attributed to it. It is probable that the fetid character acquired by the stools in the absence of bile is due to impaired intestinal digestion, and, therefore, to better opportunities for the action of bacteria, rather than to the withdrawal of any antiseptic influence exerted directly by the bile itself.

Bile is too uncertain in its action to be employed as an ordinary laxative. In *fecal impaction*, however, a solution of oxgall, containing an ounce to a pint of water (30.0 gm.–0.5 L.), often makes a very serviceable enema. When, for any reason, the biliary secretion is lacking in the intestine, oxgall may be used as an *adjuvant to certain cathartics*—podophyllum, jalap, rhubarb, and scammony—that are ordinarily inactive when bile is not present.

In cases of *biliary fistula* or of *obstruction of the common duct* it may be used to promote the digestion of fats and proteids, and to prevent, indirectly, putrefactive changes in the intestinal contents. It is best administered in capsules, about two hours after meals.

## ALOE, U. S. P.

(Aloes.)

Aloes is the inspissated juice prepared from the leaves of several species of the genus *Aloe*, a familiar example of which is the American century plant. It contains a neutral crystalline principle, *aloin*, a resin, and a trace of volatile oil. Aloin consists of a number of anthracene derivatives closely allied to those contained in rhubarb, cascara, and senna. It is less reliable than the crude drug. The dose of aloes is from 1–10 gr. (0.065–0.65 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Aloinum, U. S. P. | ½–2 gr. (0.016–0.13 gm.). |
| Aloe Purificata, U. S. P. | 1–10 gr. (0.065–0.65 gm.). |
| Tinctura Aloes, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Tinctura Aloes et Myrrhæ, U. S. P. (10 per cent. of each, with glycyrrhizæ) | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Pilulæ Aloes, U. S. P. (about 2 gr.—0.13 gm.) | 1–5 pills. |
| Pilulæ Aloes et Ferri, U. S. P. (about 1 gr.—0.065 gm.—each of aloes and ferrous sulphate) | 1–3 pills. |
| Pilulæ Aloes et Mastiches, U. S. P. (Lady Webster's pills; about 2 gr.—0.13 gm.—of aloes, with mastich and red rose) | 1–5 pills. |
| Pilulæ Aloes et Myrrhæ, U. S. P. (2 gr.—0.13 gm.) | 1–4 pills. |

| Preparations. | Dose. |
|---|---|
| Pilulæ Laxativæ Compositæ, U. S. P. (¼ gr.—0.013 gm. of aloin, with strychnin, extract of belladonna, and ipecac) | 1–3 pills. |
| Pilulæ Rhei Compositæ, U. S. P. (1½ gr.—0.1 gm.—each) | 1–3 pills. |

Aloes also enters into compound extract of colocynth (50 per cent.), compound tincture of benzoin (2 per cent.), compound cathartic pills, and vegetable cathartic pills.

**Physiologic Action and Therapeutics.**—Aloes is a slowly acting but brisk purgative. A dose of 2 or 3 grains ordinarily produces one or two copious, dark-brown stools in the course of ten or twelve hours. The evacuation is generally attended with more or less griping pain. Large doses congest the pelvic viscera and irritate the rectum. It has been shown that a part of that which is ingested escapes from the body in the urine, and, in the case of nursing women, in the milk. Aloes also causes catharsis when introduced into the system through channels other than the mouth, such as the skin and the rectum. When injected into the bowel, however, it is active only when combined with a solvent, like oxgall or glycerin. Aloin is slower in its action and somewhat less certain in its effects than aloes. Aloes is rarely used singly as a cathartic, but in *simple, persistent constipation* it is very efficacious in combination with other remedies, particularly with nux vomica, belladonna, ipecac, rhubarb, or podophyllum. *Chlorosis* with constipation often yields to pills of aloes and iron. Contrary to what was formerly believed, the use of aloes is not contraindicated by the existence of hemorrhoids unless inflammation has developed; indeed, the drug often benefits *indolent piles* by overcoming the sluggishness of the bowel that led to their development. Since it congests the pelvic organs, aloes is sometimes serviceable as an emmenagogue in *amenorrhea* associated with troublesome constipation, and that is not dependent upon inflammation of the uterus or adnexa.

When dysentery, cystitis, or inflammation of any pelvic organ is present, aloes should be avoided. On account of the possibility of its causing abortion it is best not to use it during pregnancy.

Aloes is usually administered in the form of pills. The liquid preparations, on account of their disagreeable taste, are rarely employed. Meyer has shown that the action of the drug is increased by the addition of potassium carbonate or ferrous sulphate.

## RHEUM, U. S. P.

(Rhubarb.)

Rhubarb is the root of *Rheum officinale*, and other s
*Rheum*, a perennial herb, resembling garden rhubar
larger growth, and a native of China, Thibet, and oth
countries. It contains a number of anthracene bodies
*cathartin*, and *chrysophanic acid*) and a considerable qu
*tannic acid*. Chrysophanic acid has not the purgati
of the other anthracene bodies, owing to its rapid ab
The dose of rhubarb is from 5–30 gr. (0.3–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Rhei, U. S. P. (20 per cent., with cardamom) | 1–2 fl. dr. (4.0–8.0 |
| Tinctura Rhei Aromatica, U. S. P. (20 per cent., with aromatics) | ½–1 fl. dr. (2.0–4.0 |
| Fluidextractum Rhei, U. S. P. | 10–30 min. (0.6–2.0 |
| Extractum Rhei, U. S. P. | 5–10 gr. (0.3–0.65 |
| Mistura Rhei et Sodæ, U. S. P. (1.5 per cent. of the fluid extract with sodium bicarbonate, fluid extract of ipecac, and spirit of peppermint) | ½–2 fl. dr. (2.0–8.0 |
| Syrupus Rhei, U. S. P. (10 per cent. of fluid extract) | 1–6 fl. dr. (4.0–22. |
| Syrupus Rhei Aromaticus, U. S. P. (spiced syrup of rhubarb: 15 per cent. of aromatic tincture) | 1–6 fl. dr. (4.0–22 |
| Pulvis Rhei Compositus, U. S. P. (Gregory's powder: rhubarb, 25; magnesia, 65; ginger, 10) | 20–60 gr. (1.3–4.0 |
| Pilulæ Rhei Compositæ, U. S. P. (rhubarb, 2 gr.—0.13 gm.; aloes, 1½ gr.—0.1 gm.; myrrh; and oil of peppermint) | 1–5 pills. |

**Physiologic Action and Therapeutics.**—In ap
doses rhubarb acts as a purgative and stomachic.
the bowel more promptly than aloes, a full dose of
30 gr. (1.3–2.0 gm.) usually producing evacuation in
to eight hours. On account of the tannic acid that it
it frequently causes constipation as a secondary effect
of from 1–3 gr. (0.065–0.2 gm.) often exert no catha
ence, but act upon the stomach as a tonic and mild a
It is eliminated in the various secretions—urine, s
sweat—and imparts to them a yellowish color.

Rhubarb is an excellent remedy for removing irr
terial from the bowel in the beginning of *acute diar*
the *dyspeptic diarrhea of childhood* the withdrawal o
for several hours and the administration of a few dos
aromatic syrup with magnesia generally affords
relief:

℞ Magnesii oxidi, gr. xl (2.6 gm.);
Syrupi rhei aromatici, f℥vj (22.5 c.c.);
Aquæ menthæ piperitæ, q. s. ad f℥j (30.0 c.c.).—**M.**
Sig. A teaspoonful repeated once or twice for a child two years old.

Rhubarb alone is not a suitable remedy for *chronic constipation*, but benefit is often derived from a combination of small doses with other cathartics. *Mild attacks of indigestion* the result of overindulgence, frequently yield to the union of rhubarb with an antacid:

℞ Pulveris nucis vomicæ, gr. xii (0.8 gm.);
Pulveris rhei, gr. xxiv (1.5 gm.);
Sodii bicarbonatis, ʒj (4.0 gm.).—**M.**
Fiant chartulæ No. xii.
Sig. One before meals.

## SENNA, U. S. P.

Senna is the leaflets of *Cassia acutifolia* and of *Cassia angustifolia*, small shrubs growing respectively in Africa and India. It contains a number of anthracene bodies, chief of which is *cathartin* or *carthartinic acid*. The dose is from 1–3 dr. (4.0–12.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Sennæ, U. S. P. . . . . | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Syrupus Sennæ, U. S. P. (25 per cent.) . . . | 1–4 fl. dr. (4.0–16.0 c.c). |
| Infusum Sennæ Compositum, U. S. P. (Black Draft: senna, 6; fennel, 2; manna, 12; Epsom salts, 12) . . . . . | 1–4 fl. oz. (30.0–120.0 c.c.). |
| Confectio Sennæ, U. S. P. (10 per cent., with cassia fistula, tamarind, prune, fig, sugar, and coriander oil) . . . . . | 1–2 dr. (4.0–8.0 gm.). |
| Pulvis Glycyrrhizæ Compositus, U. S. P. (18 per cent. of senna, with licorice, sulphur, sugar, and fennel oil) . . . . . | ½–2 dr. (2.0–8.0 gm.). |

Senna (1.5 per cent. of the fluid extract) also enters into compound syrup of sarsaparilla.

**Physiologic Action and Therapeutics.**—Senna is an energetic purgative. A full dose produces in from four to six hours one or two yellowish, loose, or even watery, stools, the evacuation being attended with considerable griping and flatulence. Its action is more irritating than that of rhubarb, and more prompt and powerful than that of aloes. Very large doses cause nausea, vomiting, violent purging, and depression. Cathartinic acid also acts when injected subcutaneously. Like rhubarb, senna imparts to the urine a deep yellow or red color, the pigmentation being due to the presence of chrysophanic acid. Senna is a safe and reliable purgative for unloading the bowel in *simple, acute constipation*. Its

tendency to cause griping is in a measure corrected by giving it with an aromatic or a saline. Compound licorice powder, in doses of a teaspoonful, more or less, at bedtime, is a popular household remedy in *habitual costiveness.*

## PHENOLPHTHALEIN.

(Purgen.)

Phenolphthalein is an artificial anthracene derivative, prepared by the interaction of phenol and phthalic anhydride. It is a white crystalline powder, soluble in 600 parts of water and in 10 of alcohol. The dose is from 1 to 8 gr. (0.6–0.5 gm.) in powder, capsule, or pill.

Phenolphthalein is an agreeable, fairly reliable, but slowly acting purgative. In the doses indicated it appears to have no other action.

## OLEUM RICINI, U. S. P.

(Castor Oil.)

Castor oil is a fixed oil expressed from the seed of *Ricinus communis*, a plant indigenous to India, but extensively cultivated in other countries having a warm or temperate climate. It is a pale-yellowish, viscid oil, having a faint odor and a slightly acrid, offensive taste. It is freely soluble in alcohol. It is composed chiefly of *ricinolein*, the glycerid of ricinoleic acid, which is the purgative principle. The seeds themselves are never used for medicinal purposes. They contain *ricin*, an intensely poisonous proteid body, which, when injected into the blood of an animal, causes, after the lapse of several days, anorexia, vomiting, diarrhea, and profound prostration. In fatal poisoning the chief postmortem lesions are extensive ecchymoses of the mucous and serous membranes, tumefaction of the abdominal lymph-glands, and numerous areas of necrosis in the various organs. The dose of castor oil for an infant is from 1–2 dr. (4.0–8.0 c.c.); for an adult, ½–1 ounce (15.0–30.0 c.c.).

**Physiologic Action and Therapeutics.**—Castor oil is a mild purgative, unloading the bowels thoroughly in from four to six hours, without causing much colic or flatulence. While its fate in the body has not been definitely determined, it is probable that it escapes from the stomach unchanged, and that in the presence of the intestinal juices saponification occurs with the liberation of ricinoleic acid, which is subsequently converted into ricinoleates. The latter induce catharsis by stimulating the muscular coat of the bowel, and are proba-

bly absorbed, since the oil is known to impart its purgative properties to the milk when given to nursing women.

Castor oil is not a suitable remedy for habitual constipation, but on account of its mild and speedy action it is perhaps the best remedy we possess to remove irritant material from the bowel in the beginning of *acute inflammatory diarrhea.* It is also an excellent laxative for use during *pregnancy* or *labor.*

When it is desirable to add an oil to a lotion intended for the scalp, castor oil is generally selected on account of its solubility in alcohol.

The leaves of the castor oil plant are said to promote the flow of milk when applied to the breasts.

Many substances have been suggested to disguise the disagreeable taste of castor oil, which is the main objection to its employment; those in common use are the oils of peppermint, gaultheria, and cinnamon. Wood speaks favorably of a combination of equal parts of glycerin and castor oil flavored with a drop or two of one of the above-named oils. It is often given in the froth of porter, beer, or soda-water. It may be prescribed in emulsion, but in this form it is bulky and not so effective. The best method of administering it is in flexible capsules containing a dram (30.0 c.c.) or more.

## HYDRARGYRI CHLORIDUM MITE, U. S. P.

(Mild Mercurous Chlorid; Calomel; $Hg_2Cl_2$.)

Calomel is a white, odorless, tasteless powder, insoluble in all ordinary menstrua. The dose is from $\frac{1}{10}$–10 gr. (0.0065–0.65 gm.).

| Preparations. | Dose. |
|---|---|
| Pilulæ Antimonii Compositæ (Plummer's Pills; $\frac{2}{3}$ gr.—0.04 gm.—of calomel and sulphurated antimony with guaiac and castor oil) | 1–2 pills. |
| Pilulæ Catharticæ Compositæ, U. S. P. (1 gr.—0.06 gm.—of calomel, with gamboge, compound extract of colocynth, and extract of jalap) | 1–3 pills. |

Calomel acts as a laxative or as a purgative according to the method of its administration and the susceptibility of the patient. Unlike other cathartics, its effect does not increase in direct ratio with the dose. Fractional doses repeated every half hour until 1 or 2 gr. (0.065–0.13 gm.) have been taken generally operate more freely than a dose of 10 gr. (0.65 gm.) taken at once. Calomel produces a thorough evacuation, the stools being large and loose, and commonly charged with undecomposed bile. Its action is not usually accompanied

by much griping, but in some persons the drug excit
or less nausea. The change that calomel undergoe
body is still a matter of dispute. It was formerly s
that at least a portion was converted into mercuric ch
the hydrochloric acid of the stomach, but the experi
Bucheim, Winkler, and Jeannel prove that such a co
is impossible at the temperature of the body. It
probable, as Jeannel suggests, that in the presence of t
line juices of the intestines the drug is changed int
oxid, a compound that is freely soluble in oily alkal
tures, such as are naturally present in the duodenum.
or not calomel directly increases the secretion of
another question that has evoked considerable discus
to which no definite answer can be given at the pres
There can be no doubt that the amount of bile disch
the stools is actually increased under its influence,
evidence, experimental and clinical, does not favor
that calomel increases the quantity of bile formed by t
on the contrary, it suggests that the drug, through it
lant action on the duodenum, merely speeds the flo
through the intestines and prevents its reabsorption.

No remedy is so useful as calomel in the conditio
as "*biliousness*," which is characterized by a thickl
tongue, fetid breath, heavy urine, headache, and d
of spirits. A sixth of a grain (0.01 gm.) may be giv
fifteen or twenty minutes until 1 gr. (0.065 gm.) h
taken. If the bowels do not move freely, the mercu
be followed by Epsom salts or a Seidlitz powder.
of *indigestion associated with clay-colored stools*,
children or adults, are often relieved by a few sma
of calomel. In *dyspeptic diarrhea* it is not quite
cious as castor oil in removing undigested food
bowel, but it has advantages in its tastelessness a
bulk. In the beginning of *acute disease*, especially th
infections, it is an excellent cathartic for unloading th
without exciting irritation. In *chronic heart dise*
venous engorgement of the digestive organs calomel
utmost value in relieving the tension in the portal ci
and without its aid digitalis often proves ineffectual.

**Massa Hydrargyri, U. S. P.** (Blue Mass) is
triturating mercury, 33; glycyrrhiza, 10; althæa, 15;
9; and honey of rose, 33. It is employed for the s
poses as calomel, although it is less active. The dos
$\frac{1}{4}$–15 gr. (0.016–1.0 gm.).

**Hydrargyrum cum Creta, U. S. P.** (mercury wi

gray powder).—This is an intimate mixture of mercury, honey, and chalk, containing 38 per cent. of mercury. It is weaker than blue mass. The dose is from 1–10 gr. (0.065–0.65 gm.).

## OLEUM TIGLII, U. S. P.

(Croton Oil.)

Croton oil is a fixed oil expressed from the seeds of *Croton Tiglium*, a small tree, indigenous to China, but extensively cultivated in India and the Philippine Islands. It is a yellowish, viscid oil, having a faint odor and an acrid, burning taste. In addition to several inactive fatty acids it contains *crotonoleic acid*, which is present both as a free acid and as a glycerid. The dose of the oil is from $\frac{1}{4}$–2 min. (0.03–0.12 c.c.).

**Physiologic Action and Therapeutics.**—When applied to the skin, croton oil causes redness and burning, followed by a copious eruption of pustules. When taken internally, it acts as a violent drastic cathartic, causing in from one to two hours several copious movements, which are partly formed and partly watery. The evacuations are usually attended with considerable pain, and not infrequently with nausea. Large doses produce all the symptoms of a severe gastro-enteritis. As croton oil contains a certain amount of free crotonoleic acid, it causes, when swallowed without a demulcent, a burning sensation in the fauces and stomach, but its maximum irritant effect is not manifested until it reaches the intestine, where the bulk of the acid is liberated from the oil by saponification.

On account of the ease with which it can be administered croton oil is a well-adapted cathartic for cases in which deglutition is seriously affected. Its prompt irritant action on the bowel makes it also a useful revulsant in cases of cerebral congestion. Thus, it may be given with advantage in *uremia*, *apoplexy*, and *acute mania*.

It is also useful in very *obstinate constipation*, such as occurs in chronic lead-poisoning. As it acts promptly when simply placed on the back of the tongue, it is often selected as a cathartic for the insane. Its use is contraindicated whenever there is inflammation of the gastro-intestinal tract.

The drug is best administered in a little olive oil or in a pill with bread-crumb as an excipient.

Croton oil is sometimes used externally as a counterirritant. It is rarely applied to the skin in the pure state, a mixture with from 2 to 4 parts of some indifferent oil generally being preferred. A liniment is official in the British Pharmacopœia that is made of 2 parts of the oil with 7 parts each of oil of

cajuput and alcohol. This liniment may be applie chest in *chronic bronchitis*, *phthisis*, or *fibrinous pleu*

A mixture of croton oil (1 part) and tincture (3 parts) employed as a pigment often acts very *neuritis*.

## COLOCYNTHIS, U. S. P.

(Colocynth.)

Colocynth is the fruit of *Citrullus Colocynthis* depriv rind. The plant grows in arid places in Asia, Af Southern Europe. The chief cathartic principle is *col* a bitter glucosid.

| PREPARATIONS. | DOSE. |
|---|---|
| Extractum Colocynthidis, U. S. P. . . . . | 2–5 gr. (0.13–0. |
| Extractum Colocynthidis Compositum, U. S. P. (extract of colocynth, 16; aloes, 50; resin of scammony, 14; cardamom, 6; soap, 14) . . | 5–20 gr. (0.3–1. |
| Pilulæ Catharticæ Compositæ, U. S. P. (each pill contains about 1¼ gr.—0.08 gm.—of compound extract of colocynth; 1 gr.—0.06 gm.—of calomel; ⅓ gr.—0.02 gm.—of resin of jalap; ¼ gr.—0.015 gm.—of gamboge) . . . . . | 1–3 pills. |
| Pilulæ Catharticæ Vegetabiles, U. S. P. (each pill contains about 1 gr.—0.06 gm.—of compound extract of colocynth; ⅓ gr.—0.02 gm.—of resin of jalap; ½ gr.—0.03 gm.—of extract of hyoscyamus; ¼ gr.—0.015 gm.—of extract of leptandra; ¼ gr.—0.015 gm.—of resin of podophyllum; oil of peppermint . . . . . | 1–3 pills. |

**Physiologic Action and Therapeutics.**—Colo a powerful drastic cathartic, producing in full doses watery stools, which are often accompanied by griping large doses excite intense inflammation of the whole tary tract, which may prove fatal. The drug is too ir be used alone. At the present time it is prescribed i nation with other remedies only in *obstinate chronic tion*. It is not a suitable cathartic for habitual use, bu be employed now and then to secure a thorough ev of the bowels.

## CAMBOGIA, U. S. P.

(Gamboge.)

Gamboge is a gum-resin from *Garcinia Hanburii*, like tree growing in the East Indies. Its active pr *cambogic acid*. The dose is from ½–5 gr. (0.03–0.3 gr

| PREPARATION. | Do |
|---|---|
| Pilulæ Catharticæ Compositæ, U. S. P. (about ¼ gr.—0.015 gm.—in each pill) . . . . . | 1–3 |

**Physiologic Action and Therapeutics.**—Gamboge is an extremely irritating drastic cathartic, fully capable in large doses of causing fatal gastro-enteritis. It is never used alone, but in combination with less powerful cathartics it is sometimes employed in *obstinate chronic constipation.*

## SCAMMONIUM, U. S. P.

(Scammony.)

Scammony is a resinous exudation from the living root of *Convolvulus Scammonia*, a perennial herb growing in Western Asia. Its active principle is a resin, *scammonin*, which appears to be identical with jalapin. The dose of scammony is from 1–10 gr. (0.06–0.6 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Resina Scammonii, U. S. P. . . . . | 2–8 gr. (0.13–0.5 gm.). |
| Extractum Colocynthidis Compositum, U. S. P. (14 per cent.) . . . . . | 5–20 gr. (0.3–1.3 gm.). |

**Physiologic Action and Therapeutics.**—Scammony has been used as a drastic cathartic since the time of Hippocrates. It is more powerful than jalap, but less irritating than gamboge. It is rarely employed except in the form of the "compound cathartic pill."

## PODOPHYLLUM, U. S. P.

(May Apple; Mandrake.)

Podophyllum is the rhizome and roots of *Podophyllum peltatum*, a perennial herb growing in moist shady places in Canada and Northern United States. It contains two isomeric glucosids—*podophyllotoxin* and *picropodophyllin.*

| PREPARATIONS. | DOSE. |
|---|---|
| Resina Podophylli, U. S. P. (Podophyllin) . | $\frac{1}{3}$–$\frac{1}{2}$ gr. (0.008–0.03 gm.). |
| Fluidextractum Podophylli, U. S. P. . . . . | 5–20 min. (0.3–1.2 c.c.). |
| Pilulæ Podophylli, Belladonnæ et Capsici, U. S. P. (each pill contains $\frac{1}{4}$ gr. (0.016 gm.) of resin of podophyllum, $\frac{1}{8}$ gr. (0.008 gm.) of extract of belladonna, and $\frac{1}{2}$ gr. (0.32 gm.) of capsicum) . . . . . | 1–2 pills. |

The resin also enters into vegetable cathartic pills.

**Physiologic Action and Therapeutics.**—In full doses podophyllum is an active, irritant cathartic. It produces its effects slowly, however—rarely earlier than ten or twelve hours after its administration—the evacuations being copious and liquid, and generally attended with much griping pain. It is said to act as a cathartic when applied to an open wound or

administered subcutaneously. It is believed by ma
titioners to possess the power of directly increas
secretion of bile, but very little evidence can be add
support this claim.

Podophyllum is especially prized as a cathartic in
*constipation*, associated with so-called "bilious attac
many persons the action of the drug is very agreeabl
others it causes severe pain and depression. When c
with other cathartics only those should be selected w
also slow in action, such as aloes and calomel. Ex
belladonna or hyoscyamus may be added to prevent
The resin is the most reliable preparation. A com
like the following often makes a useful dinner pill:

℞ Resinæ podophylli, gr. iv (0.26 gm.);
Aloes purificatæ, gr. xx–xl (1.3–2.6 g
Extracti nucis vomicæ,
Extracti belladonnæ, aa gr. iv (0.26 gm.).—
Fiant pilulæ No. xx.
Sig. One at bedtime.

## JALAPA, U. S. P.

(Jalap.)

Jalap is the dried tuberous root of *Exogonium*
perennial herb growing in Mexico. It contains tw
glucosids, *convolvulin* and *jalapin*. The dose is from
(0.3–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Resina Jalapæ, U. S. P. . . . . | 1–5 gr. (0.065–0.3 g |
| Pulvis Jalapæ Compositus, U. S. P. (35 per cent. of jalap and 65 per cent. of potassium bitartrate) . . . . . | 15–60 gr. (1.0–4.0 g |
| Pilulæ Catharticæ Compositæ, U. S. P. ($\frac{1}{3}$ gr. —0.02 gm.—of extract) . . . . . | 1–3 pills. |
| Pilulæ Catharticæ Vegetabiles, U. S. P. ($\frac{1}{3}$ gr. —0.02 gm.—of extract) . . . . . | 1–3 pills. |

**Physiologic Action and Therapeutics.**—Jal
powerful hydragogue cathartic. It acts generally witl
or four hours, and produces copious watery stools.
infrequently excites nausea and colic, but its actior
harsh than that of either gamboge or scammony. A
to Stadelmann, it is inactive in the absence of bile, tl
probably serving as a solvent. Except as an ingre
"compound cathartic pills" or "vegetable catharti
jalap is not employed in simple constipation. It is us
cially for the removal of *dropsical effusions*, and for t
pose it is frequently combined with a saline, as in th
compound jalap powder. Associated with calomel

sometimes a valuable depletive in *chronic heart disease* with congestion of the portal circulation.

## ELATERIUM.

Elaterium is a substance deposited by the juice of *Ecballium Elaterium*, or squirting cucumber, a vine growing on the shores of the Mediterranean Sea. It is of uncertain strength and is not official, but its active properties are fully represented by a neutral principle, *elaterin* (Elaterinum, U. S. P.), which is official. The latter occurs in minute white scales or crystals, without odor, and having an acrid, bitter taste. It is almost insoluble in water, but readily soluble in chloroform and hot alcohol. The dose of elaterium is from $\frac{1}{8}$–$\frac{1}{2}$ gr. (0.008–0.03 gm.).

| Preparations. | Dose. |
|---|---|
| Elaterinum, U. S. P. | $\frac{1}{30}$–$\frac{1}{10}$ gr. (0.002–0.0065 gm.). |
| Trituratio Elaterini, U. S. P. (10 per cent., with sugar of milk) | $\frac{1}{4}$–1 gr. (0.016–0.065 gm.). |

**Physiologic Action and Therapeutics.**—Elaterium is a decided irritant to all tissues. Given internally it is, perhaps, the most powerful of the hydragogue cathartics, producing large watery stools, with some griping, and, occasionally, nausea. Its action is more vigorous than that of jalap and less harsh than that of gamboge or colocynth. In overdoses it is a violent, acrid poison.

In appropriate doses elaterium is often very useful in reducing *local serous effusions* (hydrothorax, hydropericardium, ascites) and the *general dropsy* of cardiac or renal disease. On account of its prompt action it may be employed also as a derivative in *cerebral congestion* and *uremia*. Elaterium itself, probably on account of its adulteration, is unreliable, and, therefore, only official preparations should be prescribed.

## BRYONIA.

(Bryony.)

Bryonia is the root of *Bryonia alba* and of *Bryonia dioica*, a perennial climbing plant growing in Central and Southern Europe. Its active principle is probably *bryonin*, an intensely bitter, soluble glucosid.

| Preparation. | Dose. |
|---|---|
| Tinctura Bryoniæ | 1–2 fl. dr. (4.0–8.0 c.c.). |

Bryonia is a drastic, hydragogue cathartic. It was formerly

a much esteemed remedy in general dropsy and local e
but at present it is very rarely used.

## MAGNESII SULPHAS, U. S. P.

(Magnesium Sulphate; Epsom Salt; $MgSO_4 + 7H_2O$.)

Magnesium sulphate occurs in small, colorless,
prisms or acicular crystals, odorless, and having an unp
bitter, saline taste. It is soluble in 1.5 parts of water,
soluble in alcohol. The dose is from 1–8 dr. (4.0–30.0

| PREPARATIONS. | DOSE. |
|---|---|
| Magnesii Sulphas Effervescens, U. S. P. . . | 1–8 dr. (4.0–30.0 gm |
| Infusum Sennæ Compositum (12 per cent.), U. S. P. . . . . | 1–4 fl. oz. (30.0–120 |

**Physiologic Action.**—The saline cathartics, o
magnesium sulphate may be taken as a type, produce
tion of the bowels chiefly by increasing the amount of
the intestine. Unlike the vegetable cathartics, they
feeble stimulants to peristalsis. They hinder the ab
of fluid taken with food, and they also abstract fluid
from the tissues and blood. The increased bulk and
of the intestinal contents give an impetus to perista
purgation follows, but there is little direct irritation of t
cular coat of the bowel, as occurs with the vegetable ca
Under ordinary conditions saline cathartics are a
from the intestine very slowly and in but small quanti
greater part escaping from the body in the stools.
action, therefore, appears to be a purely local one, a
view is supported by the fact that they do not produce
when injected intravenously. It is a noteworthy fact th
a saline cathartic is administered to an anhydremic
instead of the blood yielding its water to the intes
process is reversed, and the blood attracts fluid from th
the salt is in large part absorbed, and purgation does no

Saline cathartics, by concentrating the blood, p
lessen the secretion of urine; subsequently, howeve
may be absorbed from the intestine in sufficient qua
exert a diuretic effect.

In full doses and in concentrated solution magnesi
phate is an active hydragogue cathartic, producing
course of a few hours copious watery stools withou
pain or systemic disturbance. Its chief drawback is
dency to excite nausea. Dilute solutions are much les
as purgatives, but, being more readily absorbed, they

the flow of urine. Meltzer has shown that magnesium salts, when injected intravenously, inhibit the respiration and cause paralysis of the entire body; that, when applied directly to a nerve, they produce complete nerve block, and that, when injected into the spinal meninges, they cause general anesthesia, muscular relaxation, and sleep lasting for several hours.

**Therapeutics.**—Since Epsom salt is free from irritant properties, it is an excellent cathartic for removing undigested material from the bowel in *acute enteritis* and *colitis*. On account of its unpleasant taste and large bulk, however, it is not so convenient for children as calomel, or even castor oil. As it increases the fluidity of the intestinal contents it is well suited for use in cases of *fecal accumulation*. In *chronic constipation* a saline taken in small dose before breakfast is sometimes more efficacious than a vegetable cathartic. It is an excellent remedy for reducing *dropsical effusions*, both local and general. Recently several competent observers have testified to the value of Epsom salt in the treatment of *tropical dysentery*. Doses of from 1–2 dr. (4.0–8.0 gm.) are recommended to be given in some aromatic water, and continued until the stools lose their mucous character.

Magnesium sulphate is also used as an antidote to *acute lead-poisoning* and to *carbolic acid poisoning*. With sugar of lead it forms an insoluble sulphate, and with carbolic acid an innocuous phenolsulphonate.

As a result of Meltzer's observations, intraspinal injections of Epsom salt (2–4 c.c. of a 25 per cent. solution) have been employed to some extent in controlling the convulsions of *tetanus*. Although the treatment seems to have been decidedly beneficial in a number of severe cases, great caution is urged in adopting it, owing to the frequency with which marked depression of the respiration occurs.

**Administration.**—When a full hydragogue effect is desired, the drug should be given before breakfast, in one large dose, and with but a small quantity of water. In cases of general dropsy the restriction of liquids after the administration of the salt makes its action still more effective. Solutions of Epsom salt are rendered more acceptable to the stomach by the addition of magnesium carbonate (20–30 gr.—1.3–2.0 gm.). Cathartic enemata are rendered more active by the addition of Epsom salt. The following enema, recommended by Noble, will be found very efficacious in cases of marked intestinal torpor:

℞ Magnesii sulphatis, ℥ij (60.0 g
Olei terebinthinæ, f℥ss (15.0 c
Glycerini, f℥j (30.0 c.
Aquæ, q. s. ad f℥iv (120.0

**Incompatibles.**—Magnesium sulphate is inc with lead acetate, silver nitrate, alkaline carbonates, water. From solutions of sodium phosphate it p the insoluble magnesium phosphate, and from sol Rochelle salt, after a time, the insoluble magne trate.

## SODII SULPHAS, U. S. P.

(Sodium Sulphate; Glauber's Salt; $Na_2SO_4+10H_2O$.)

Sodium sulphate occurs in large, colorless, tr prisms, or granular crystals, odorless, and of a bit taste. It is soluble in 2.8 parts of water. The do 2–8 dr. (8.0–30.0 gm.).

**Therapeutics.**—Glauber's salt is a powerful hy cathartic, producing large watery stools, accomp griping and borborygmi. Epsom salt, being far less has largely superseded it. It enters into the mixtu as artificial Carlsbad salt, which makes an efficient n aperient:

℞ Sodii sulphatis, ℥v (150.0
Sodii bicarbonatis, ℥ij (60.0 g
Sodii chloridi, ℥j (30.0 gr
Sig. A teaspoonful in a tumblerful of hot water half an breakfast.

The sulphates of sodium and magnesium are t ingredients in certain natural mineral waters, such yadi Jànos, Friedrichshall, Carlsbad, Rubinat, and P

## POTASSII ET SODII TARTRAS, U. S

(Potassium and Sodium Tartrate; Rochelle Salt; $KNaC_4H_4O_6$·

Rochelle salt occurs in colorless, transparent, crystals, or as a white powder, odorless, and having saline taste. It is soluble in 1.2 parts of cool wat less than 1 part of boiling water. The dose is fro (4.0–16.0 gm.).

### PREPARATION.

Pulvis Effervescens Compositus, U. S. P. (Seidlitz powder) . 1

(The *blue paper* contains sodium bicarbonate, 40 gr.—2.6 gm.—a and sodium tartrate, 120 gr.—8.0 gm. The *white paper* contains tar gr.—2.3 gm. The contents of each paper should be dissolved separ solutions mixed, and the whole taken while effervescing.)

**Therapeutics.**—Rochelle salt may be used as a hydragogue cathartic in the same class of cases in which magnesium sulphate is indicated. It is less active than the latter salt, but more agreeable to take. Seidlitz powder is a very mild saline cathartic. The carbonic acid evolved during effervescence not only makes the solution palatable, but exerts a sedative influence on the stomach.

## SODII PHOSPHAS, U. S. P.

(Sodium Phosphate; $Na_2HPO_4+12H_2O$.)

Sodium phosphate occurs in large, colorless, prismatic crystals, odorless, and having a cooling, saline taste. It is soluble in 5.5 parts of water, and insoluble in alcohol. The dose for a young child is from 1–10 gr. (0.065–0.65 gm.); for an adult, ½–4 dr. (2.0–16.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Sodii Phosphas Effervescens, U. S. P. . . . | 1–8 dr. (4.0–30.0 gm.). |
| Sodii Phosphas Exsiccatus, U. S. P. . . . . | 10–60 gr. (0.65–4.0 gm.). |
| Liquor Sodii Phosphatis Compositus, U. S. P. (each fl. dr. (4.0 c.c.) contains 1 dr. (4 gm.) of sodium phosphate, with citric acid and sodium nitrate) . . . . . | 1–3 fl. dr. (4.0–11.0 c.c.). |

**Therapeutics.**—Sodium phosphate in small doses acts as a laxative; in large doses, as a purgative. Its mild action and agreeable taste commend it especially for children, to whom it may be given in milk or other food. It is useful also in the less severe forms of constipation occurring in adults. In *chronic gastric catarrh with constipation* small doses in hot water before meals often have a very happy effect not only on the bowel, but also on the stomach. Taken in the same way, sodium phosphate is a valuable depletive in *simple catarrhal jaundice* secondary to duodenitis.

## MAGNESII CITRAS.

(Magnesium Citrate; $Mg_32C_6H_5O_7+14H_2O$.)

Magnesium citrate is official as the *solution of magnesium citrate* (Liquor Magnesii Citratis). This preparation is an effervescing solution of magnesium citrate containing a small quantity of sugar and free citric acid. In doses of from 6–12 fl. oz. (180.0–360.0 c.c.) it is a very pleasant, but somewhat irritating, cathartic. It is suitable for occasional use, when it is desired simply to evacuate the alimentary canal. It should not be employed when there is any inflammation of the gastro-intestinal tract.

# DIURETICS.

Diuretics are agents that increase the flow of urin
may act (1) by increasing the general arterial pressur
dilating the vessels of the kidney; (3) by increasing
content of the blood (salt action); (4) by directly st
the renal epithelium.

(1) *General Circulatory Stimulants.*—The chief re
tives of this class of diuretics are:

| | |
|---|---|
| Digitalis. | Convallaria. |
| Strophanthus. | Apocynum. |

Squill.

Part of the diuretic effect of squill is to be attributed
stimulation of the renal epithelium.

*Dilators of the Renal Vessels.*—Local dilatation of t
of the kidney, if not accompanied by a reduction of th
arterial pressure, increases the secretion of urine.
some reason to believe that the purin derivatives
theobromin, theophyllin—increase urine production,
inducing local changes in the renal circulation.

*Salines.*—Salts that are readily absorbed from the
ary canal cause diuresis by drawing water into the b
distending the renal vessels. Salts that are difficult
tion, like the magnesium and sulphate ions, draw wate
bowel and act as cathartics. The following drugs
diuretic properties to salt action:

| | |
|---|---|
| Potassium bicarbonate. | Potassium nitr |
| Potassium carbonate. | Potassium chl |
| Potassium bitartrate. | Lithium carbo |
| Potassium acetate. | Lithium citrat |
| Potassium citrate. | Lithium benzo |

Dextrose and other sugars, owing to their high osm
alents, also induce diuresis, hence the polyuria of diabete

*Direct Renal Stimulants.*—The chief members of t
are:

| | |
|---|---|
| Caffein. | Calomel. |
| Theobromin. | Blue mass. |
| Theophyllin. | Scoparius. |

As pointed out above, there is some evidence to
caffein, theobromin, and theophyllin act partly by di
kidney vessels.

*Buchu, uva ursi, oil of turpentine, copaiba,* and *cubeb* also have a specific effect on the renal epithelium, but they are used chiefly to stimulate the mucous membrane of the genito-urinary tract and to inhibit bacterial growth in the urine and very rarely as diuretics. They are considered under the heading "Stimulants to the Genito-urinary Tract."

Concerning the influence of drugs upon the solids eliminated by the kidneys, we have at present very little definite knowledge. Large quantities of *water* frequently increase the solids of the urine, but it has been shown that this is due to the flushing out of waste-products and not to any increase of proteid metabolism. It is commonly believed that the *alkaline diuretics* hasten oxidation in the tissues, and in consequence increase nitrogenous elimination, but it has not been satisfactorily demonstrated that these drugs have such an action. Many of the investigations undertaken to decide the question have been attended by numerous opportunities for error, and those that have not been have given such conflicting results that no conclusions can be drawn from them.

*Digitalis, strophanthus,* and *caffein* have no pronounced effect on the excretion of the solids normally found in the urine, but the last sometimes induces a slight glycosuria.

Certain drugs which have no special activity as diuretics notably increase the solid constituents of the urine. Thus, *salicylic acid* increases the elimination of urea, uric acid, and sulphur compounds; *colchicum* probably increases the excretion of uric acid, and *thyroid extract,* by increasing the destruction of the proteids of the tissues, very decidedly augments the output of nitrogen and phosphates.

Diuretics are employed for the following purposes:

1. *To Remove Excrementitious Matters From the Blood.*—They are useful for this purpose when the secretory function of the kidneys is impaired or suspended, as it often is in acute febrile diseases, in passive congestion of the kidneys, and in some forms of Bright's disease.

2. *To Promote the Absorption and Excretion of Dropsical Effusion.*—For obvious reasons diuretics are less efficacious in dropsy resulting from organic disease of the kidneys than in that resulting from lowered arterial tension.

3. *To Lessen Irritation of the Genito-urinary Tract.*—For this purpose alkaline diuretics are useful when the urine is too concentrated or is excessively acid. They also relieve the distressing symptoms occasioned by uric acid gravel and uric acid stones, not by exercising a solvent action on the concretions, but by producing a more copious secretion of urine.

## DIGITALIS, U. S. P.

Digitalis has very little, if any, influence on the rena
lium; it produces diuresis mainly through its stimula
on the heart and blood-vessels.

In the *dropsy* of *heart disease* it is preëminent as a
when used in doses just sufficient to maintain th
degree of tension in the renal blood-vessels. We must
ber, however, that by giving it too freely we may caus
sive constriction of the arterioles, and thereby defeat t
for which we have employed it.

Various opinions are held as to the advisability
digitalis to excite the secretory function of the kidneys
*Bright's disease.* In deciding this question a very i
factor to be considered is the state of the circulati
believe that when the pulse is strong, when the secon
of the heart at the aortic cartilage is accentuated, a
dropsy is absent or is slight, the drug should not be e
On the other hand, when there are evidences of
arterial tension and when dropsy is marked, it is often
service in reëstablishing elimination through the kidn
*chronic parenchymatous nephritis* it may be used to inc
flow of urine and to reduce the dropsy, but, like
diuretics, it is a very uncertain remedy. In *chronic i*
*nephritis* so long as the arterial tension is high and t
is abundant, there is, of course, no indication for
but late in the disease, when dilatation of the heart su
and occasions oliguria, dropsy, dyspnea, and a weak,
pulse, digitalis is our most reliable remedy. In *dropsy*
*origin* the drug may be combined with mercury, as in
known Niemeyer's pill (p. 52), but its action is often di
ing. In *serous effusions of an inflammatory character*, su
encountered in pleurisy and pericarditis, it is of doubtf

## STROPHANTHUS, U. S. P.

Strophanthus is a somewhat more active diur
digitalis, probably because it raises the blood-pressur
constricting the renal arteries. It is possible, too,
drug has a very slight irritant action on the renal e
It may be employed in the same class of cases
digitalis has been recommended.

## CAFFEINA, U. S. P.

(Caffein.)

Caffein is a very powerful diuretic, acting for the n
it is generally believed, directly on the renal epithe

increases the secretion of water to a greater extent than it does the output of solids, and, therefore, it lowers the specific gravity of the urine. After the ingestion of much sugar-forming food it sometimes gives rise to a slight glycosuria. It may be employed in any form of *general dropsy* except that of acute nephritis. In *cardiac dropsy* it not infrequently surpasses digitalis in its power of producing diuresis, and a combination of digitalis and caffein may prove more effective than either drug singly. In *chronic parenchymatous nephritis* also caffein may succeed when digitalis has failed. Its tendency to cause insomnia must always be borne in mind.

## THEOBROMINA.

(Theobromin.)

Theobromin is an alkaloid closely related to caffein, and obtained from the seeds of *Theobroma Cacao*, or chocolate tree, extensively grown in South America and the West Indies. It occurs in minute whitish crystals, of a bitter taste, and sparingly soluble in water and alcohol. The dose is from 3–10 gr. (0.2–0.65 gm.). Owing to their ready solubility in water the double salts, theobromin-sodium and sodium acetate (*agurin*) and theobromin-sodium and sodium salicylate (*diuretin*), are preferred by some practitioners to the pure alkaloids. These compounds are decomposed on exposure and are incompatible with acids. Either salt may be given in doses of from 5 to 15 gr. (0.3–1.0 gm.) in peppermint-water or in capsules.

The action of theobromin resembles that of caffein, but it has much less influence than the latter on the brain and circulatory system. It produces diuresis mainly through its influence on the renal epithelium. It is eliminated in the urine partly unchanged and partly in the form of xanthin bodies, to which, like caffein, it is closely allied.

Theobromin may be used as a diuretic in the same class of cases as caffein. On account of its inferior rank as a circulatory stimulant it is not so generally useful as digitalis in the dropsy of cardiac origin, but it will be found an excellent adjuvant to that drug in some cases. In *chronic nephritis*, when degeneration of the kidneys is far advanced, like other diuretics, it often proves ineffectual in removing the dropsy.

## THEOCIN.

(Theophyllin.)

Theocin is a synthetic xanthin derivative, isomeric with theobromin (dimethyl xanthin). It is identical with theophyl-

lin, a natural alkaloid existing in small quantities in t
*sinensis*). The artificial product is a white crystall
stance with a slightly bitter taste. It is soluble in ab
parts of water.

Theocin is a powerful diuretic, but its effects are eva
rarely lasting more than four or five days. Like thec
it has little influence upon the circulation, but acts di
stimulating the renal epithelium. It may be emp
*dropsy* from any cause, excepting that of acute nephri
usually well borne, but untoward effects, such as na
vomiting, headache and vertigo, are not uncomm
secure the best results its administration should be
after a few days by that of digitalis or an alkaline diure
dose of theocin is from 5–8 gr. (0.3–0.5 gm.) in hc
after meals.

## CONVALLARIA, U. S. P.

The action of convallaria resembles that of digitalis
it has advantages in not having any cumulative effe
not disturbing the stomach, it is distinctly inferior to
both as a circulatory stimulant and as a diuretic. It
ally succeeds, however, in cases of *cardiac dropsy*
digitalis has been tried without avail.

## SCILLA, U. S. P.

(Squill.)

Squill is the bulb of the *Urginea maritima*, a peren
growing on the shores of the Mediterranean Sea. A
to Merck, it contains three active constituents, *scill*
*toxin* (*scillain*), and *scillin*. No principle, however,
yet been isolated represents fully the properties of
drug. The dose of powdered squill is from 1–3 g
0.2 gm.).

| Preparations. | Dose. |
|---|---|
| Acetum Scillæ, U. S. P. | 10–30 min. |
| Fluidextractum Scillæ, U. S. P. | 1–3 min. (0.06–0. |
| Tinctura Scillæ, U. S. P. | 5–20 min. (0.3–1. |
| Syrupus Scillæ, U. S. P. | ½–1 fl. dr. (2.0–4 |
| Syrupus Scillæ Compositus, U. S. P. (fl. ext. of squill, 8 per cent.; fl. ext. of senega, 8 per cent.; tartar emetic, 0.2 per cent.) | 10–60 min. (0.6–4 |

**Physiologic Action and Therapeutics.**—Squ
influence on the circulation very similar to that of
It also produces diuresis, partly by increasing the qu
blood flowing through the kidneys, and partly, there

to believe, by directly stimulating the renal epithelium. Large doses cause vomiting and purging, and, in addition, if much of the drug be absorbed, albuminuria and hematuria.

Squill is employed chiefly as a stimulating expectorant (see p. 288) and as a diuretic. For the latter purpose it is rarely given by itself, but in combination with digitalis. Reference has already been made to the value of a combination of digitalis, squill, and blue-mass in some cases of *cardiac* and *hepatic dropsy*. It is contraindicated in *acute nephritis*. As a diuretic it is usually prescribed in substance and in pill form.

## SCOPARIUS, U. S. P.

(Broom.)

Scoparius is the tops of *Cytisus Scoparius*, a shrub indigenous to Western Asia and Southern Europe, and cultivated in the United States. It contains a liquid alkaloid, *spartein*, and a neutral principle, *scoparin*. The salts of spartein, of which the sulphate is official, are crystalline solids. Scoparin is rarely used; its dose by the mouth is from 5–15 gr. (0.3–1.0 gm.).

| Preparations. | Dose. |
|---|---|
| Fluidextractum Scoparii . . . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Decoctum Scoparii (1 oz.–1 pint—30.0 gm.–0.5 L.) . . . . . | 1–3 fl. oz. (30.0–90.0 c.c.). |

**Physiologic Action and Therapeutics.**—The chief effect of moderate doses of scoparius is an increase in the flow of urine. The diuresis is not due to the spartein, which has an action similar to that of coniin (see p. 151), but to the scoparin, which probably acts directly on the kidney. Large doses cause vomiting and purging. Scoparius, alone or with digitalis, is sometimes efficacious in *cardiac dropsy*. The decoction is generally employed.

## APOCYNUM, U. S. P.

(Canadian Hemp.)

Apocynum is the root of *Apocynum cannabinum*, a perennial plant growing in North America, from Canada to Florida. In addition to tannin and a bitter extractive, it contains an indifferent resinous principle, *apocynin*, and an active glucosid, *apocynein*.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Apocyni, U. S. P. . . . . | 5–10 min. (0.3–0.6 c.c.). |

**Physiologic Action and Therapeutics.**—Apocynum, through its glucosid, apocynein, has an action on the circula-

tion resembling that of digitalis. Like the latter, al
creases the flow of urine. In large doses it is an activ
to the gastro-intestinal tract, causing severe vomit
purging. Apocynum has been used as a diuretic i
and *renal dropsy*, but it is unreliable and prone to dis
stomach.

## VEGETABLE SALTS OF POTASSIU

**Physiologic Action.**—In very large doses pota
a depressant to both the nervous system and the ci
system, especially to the latter. In the case of the v
salts of potassium, however, the action of the base is
nate to that of the acid radical, and a depressant effect
observed except after a very large dose of the salt o
prolonged administration. The chief effect of a mode
of any one of the vegetable salts of potassium is an i
secretion of urine. The mineral salts of the urine,
potassium and sodium, are increased, but the eviden
convincing that the salts of potassium hasten oxidati
tissues, and in consequence augment nitrogenous eli
In large doses they impart an alkaline reaction to t
The claim made by some authorities that they inc
secretion of bile has not been substantiated by rece
tigations.

**Therapeutics.**—It is an established fact that *ac
matism* is favorably influenced by the administratio
vegetable salts of potassium, but until we have
understanding of the nature of this disease it woul
less to speculate upon the *modus operandi* of the
employed in its treatment. Thirty grains (2.0 gm
alkali should be given every three or four hours
urine becomes neutral or slightly alkaline. Excelle
are often obtained by combining an alkaline salt with
compound.

Alkalis in copious drafts of water are efficient
to colchicum in the treatment of *gout;* but it is nc
whether they act by hindering the formation of uri
promoting the solution of uric acid compounds, or
benefiting gastric catarrh, relieving constipation, and
ing the activity of the kidneys.

Alkalis or mineral waters containing them are a
of service in *acute catarrh of the bile-ducts* and in *cho*
probably by relieving coexisting duodenal catarrh, a
exerting any direct influence on the bile itself or its co

They are also useful in relieving *dysuria* that is due to *excessive acidity of the urine*, and through their diluent action they tend to mitigate the suffering occasioned by *uric acid gravel* and *uric acid calculi*. In *acute Bright's disease* they serve to maintain the excretion through the kidneys and to render the urine less irritating.

Finally, the vegetable salts of potassium are efficient sedative expectorants in the beginning of *acute bronchitis*, especially when the secretion is viscid and scanty.

**Incompatibles.**—The vegetable salts of potassium are incompatible with acids, mineral salts, and alkaloidal salts.

### POTASSII BICARBONAS, U. S. P.

(Potassium Bicarbonate; $KHCO_3$.)

Potassium bicarbonate occurs in colorless prismatic crystals, odorless, and of a saline, alkaline taste. It is soluble in 3 parts of water, and almost insoluble in alcohol. The dose is from 10–30 gr. (0.65–2.0 gm.) in solution well diluted. On account of its unpleasant taste it is less frequently prescribed than the citrate and acetate of potassium. Potassium bicarbonate is used in making the following preparations:

Liquor potassii arsenitis (Fowler's solution), U. S. P.
Liquor potassii citratis, U. S. P.
Liquor magnesii citratis, U. S. P.

### POTASSII CARBONAS, U. S. P.

(Potassium Carbonate; $K_2CO_3$.)

Potassium carbonate is a white, granular, deliquescent powder, alkaline in reaction, and caustic to the taste. It is freely soluble in water, but insoluble in alcohol. The dose is from 10–30 gr. (0.65–2.0 gm.), but on account of its irritant properties it is rarely used internally. From potassium carbonate the following preparations are made:

Mistura ferri composita, U. S. P.
Pilulæ ferri carbonatis (Blaud's Pills), U. S. P.

### POTASSII BITARTRAS, U. S. P.

(Potassium Bitartrate; Cream of Tartar; $KHC_4H_4O_6$.)

Potassium bitartrate occurs in colorless or slightly opaque, rhombic crystals, or as a white powder, odorless, and of an acidulous taste. It is soluble in about 200 parts of water, and very sparingly soluble in alcohol. The dose is from 15–60 gr.

(1.0–4.0 gm.). Unlike the other vegetable salts of pot
the bitartrate resists oxidation in the body, and, therefor
of it is eliminated unchanged. As it is not readily a
from the alimentary canal, it is also an aperient. The
tartrate of potassium and sodium (Rochelle salt) is for
adding potassium bitartrate to a hot solution of sodi
bonate.

| PREPARATION. | DOSE. |
|---|---|
| Pulvis Jalapæ Compositus, U. S. P. (jalap, 35; potassium bitartrate, 65) . . . . . | 15–60 gr. (1.0–4.0 |

### POTASSII ACETAS, U. S. P.

(Potassium Acetate; $KC_2H_3O_2$.)

Potassium acetate occurs as a white powder or as
line masses, very deliquescent, odorless, and of a salir
It is soluble in 0.4 part of water and in 2 parts of
The dose is from 15–60 gr. (1.0–4.0 gm.). On accour
ready solubility, pleasant taste, and freedom from
properties, potassium acetate is a favorite alkaline

### POTASSII CITRAS, U. S. P.

(Potassium Citrate; $K_3C_6H_5O_7 + H_2O$.)

Potassium citrate occurs in transparent, prismatic cry
white, granular powder, deliquescent on exposure to a
less, and having a pleasant saline taste. It is solubl
part of water, but sparingly soluble in alcohol. The
from 15–60 gr. (1.0–4.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Liquor Potassii Citratis, U. S. P. (neutral mixture) . . . . . | ½–1 fl. oz. (15.0–30. |
| Potassii Citras Effervescens, U. S. P. . . . | 30–90 gr. (2.0–6.0 |

The citrate of potassium has properties closely res
those of acetate of potassium, and the two salts may
interchangeably. The solution of potassium citrate is
*mild febrile conditions* to promote the secretion of the
kidneys.

### POTASSII NITRAS, U. S. P.

(Potassium Nitrate; Saltpeter; $KNO_3$.)

Potassium nitrate occurs as colorless, transparent,
prisms, or as a crystalline powder having a cooling, sal
It is permanent in the air. It is soluble in 3.6 parts
and sparingly soluble in alcohol. The dose is from
(0.3–1.3 gm.), in solution, well diluted.

**Physiologic Action.**—Beyond being more irritating to the stomach, the effect of potassium nitrate in moderate doses is not materially different from that of the vegetable salts of potassium. Like the latter, it increases the flow of urine through its direct action on the secreting cells of the kidneys. In large doses potassium nitrate is not only more irritating than the vegetable salts, but, owing to the relatively greater influence of the metallic base,—potassium,—it is distinctly more depressing to the heart and nervous system. The drug is partly eliminated in the urine and saliva unchanged; a greater part undergoes reduction in the tissues, but its educts are at present unknown.

**Toxicology.**—Toxic doses produce the symptoms of acute gastro-enteritis, profound muscular weakness, and collapse. In some instances diuresis is replaced by oliguria or anuria.

**Therapeutics.**—Potassium nitrate may be employed as a diuretic in *general dropsy*, but its utility is no greater than that of the acetate or bitartrate of potassium, which are less irritating to the gastro-intestinal tract. Inhalation of the smoke of burning niter paper is sometimes effective in *asthma*.

## POTASSII CHLORAS, U. S. P.

(Potassium Chlorate; $KClO_3$.)

Potassium chlorate occurs in the form of colorless, crystalline plates, odorless, and of a cooling saline taste. It is soluble in 16 parts of water, and sparingly soluble in dilute alcohol. The dose is from 3–10 gr. (0.2–0.65 gm.), in solution, well diluted.

| Preparation. | Dose. |
|---|---|
| Trochisci Potassii Chloratis, U. S. P. (each contains about 2½ gr.—0.15 gm.) | 1–4 troches. |

**Physiologic Action.**—When applied in dilute form to mucous membranes, potassium chlorate produces a stimulating and alterative effect; in concentrated form it is a decided irritant. When taken internally it does not, as was formerly believed, yield its oxygen to the blood, but it passes out of the body unchanged. Most of it—more than 90 per cent.—escapes in the urine, but, according to Isambert, small quantities can be recovered from the saliva, the tears, and the milk of nursing women. The only appreciable effect of moderate doses, well diluted, is an increase in the flow of urine. Concentrated solutions, even of therapeutic doses, give rise to a

burning sensation in the stomach, followed by nau vomiting. Jacobi[1] was the first to point out that the of giving the drug internally in large doses was a da one, and to prove that many deaths that had been at to other causes were in reality due to potassium poisoning.

**Toxicology.**—The symptoms of potassium chlo soning are the resultant of the drug's action on th digestive tract, kidneys, and blood. Through its basi it depresses the circulation, and through its acid r irritates the stomach, intestines, and kidneys, and als a peculiar change in the blood—namely, the conv hemoglobin into methemoglobin, a compound very t of its oxygen. The first symptoms of poisoning a and abdominal pain, followed by vomiting and purgin nosis is almost constantly present, and is accompa dyspnea and the usual phenomena of cardiac failu urine is scanty, dark colored, and albuminous, and o scopic examination reveals numerous pigmented t and granular detritus derived from the red blood-cells dice is often present, and in many cases death is pre coma and convulsions. The immediate cause of de be heart failure, asphyxia, or uremia, according as t of the poison has been most pronounced on the cir blood, or kidneys. Apart from gastro-enteritis and r the most striking postmortem change is that which the blood. The color of the blood is changed to a c hue, oxyhemoglobin is replaced by methemoglobin, a of the red cells are decolorized and more or less disin The organs generally may be chocolate colored f accumulation in the tissues of liberated blood-pigm the recorded cases the minimum fatal dose for an a been 4 drams; for a child of four years, 3 drams; an infant, 1 dram.

The *treatment of poisoning* consists in evacuating the and in administering demulcents and diluents. Subc injections of normal salt solution may be tried.

**Therapeutics.**—Potassium chlorate makes an e local application in inflammatory affections of the m throat. Thus, it is valuable in the various forms of s and in *acute pharyngitis*. In these affections a sol from 10–20 gr. (0.65–1.3 gm.) to the ounce (30.0 c.c.) used as a wash or gargle. In acute pharyngitis tannic acid preparation containing it is frequently added to the solu

[1] *Medical Times*, April, 1861.

In *scarlatina* and *diphtheria* it is generally advisable to avoid solutions of potassium chlorate, and to select an agent that, if swallowed, will not contribute to the existent renal irritation. In *ulcerous stomatitis* this salt is almost a specific, and may be used internally as well as locally. The dose for a child of three years is from 2–3 gr. (0.13–0.2 gm.), well diluted, every three hours. Benefit from its internal administration is to be attributed to its continuous elimination in the saliva. Tincture of ferric chlorid may be used as an adjuvant, as in the following formula:

℞. Potassii chloratis, gr. xl (2.6 gm.);
Tincturæ ferri chloridi, ♏xxxij (2.0 c.c.);
Syrupi zingiberis, f℥vj (22.5 c.c.);
Aquæ, q. s. ad f℥ij (60.0 c.c.).—M.
Sig. A teaspoonful in water every three hours.

It is generally believed that *salivation* is less likely to result from the continuous use of mercury when a solution of potassium chlorate is used at the same time as a mouth-wash. In some cases of *syphilis* troches of the salt are useful as preventives of both mercurial stomatitis and of mucous patches.

**Incompatibles.**—Owing to rapid oxidation or reduction violent explosion may occur when potassium chlorate is triturated with such substances as tannic acid, phosphorus, pulverized charcoal, sulphur, sulphids, sugar, hyposulphites, hypophosphites, and ammonium chlorid. Mixtures of potassium chlorate, tincture of ferric chlorid, and glycerin, when warm, are liable to explode. The salt reacts with strong hydrochloric acid, setting free chlorin gas; with potassium iodid it may form the exceedingly irritant potassium iodate, and from syrup of ferrous iodid it may precipitate free iodin.

## LITHII CARBONAS, U. S. P.

(Lithium Carbonate; $Li_2CO_3$.)

Lithium carbonate occurs as a white powder, odorless, and of an alkaline taste. It is soluble in 75 parts of water and insoluble in alcohol. Its dose is from 5–20 gr. (0.3–1.3 gm.).

**Physiologic Action and Therapeutics.**—The effect of the vegetable salts of lithium is very similar to that of the corresponding salts of potassium; like the latter, they increase the quantity of urine and lessen its acidity. Lithium salts were originally recommended in the treatment of *gout* and the *uric acid diathesis* because it was found that outside of the body lithium united with uric acid to form a more soluble salt than

did either sodium or potassium; but as it has been clea onstrated that alkaline medication is without influenc urates present in the blood or tissues, it is very whether the salts of lithium are any more potent diseases than the vegetable salts of potassium. The mineral waters are extensively employed in the treat gout and nephrolithiasis, but any efficacy that they n sess is probably dependent upon the depurant actio water itself and not upon the small amount of s contain.

### LITHII CITRAS, U. S. P.

(Lithium Citrate; $Li_3C_6H_5O_7 + 4H_2O$.)

Lithium citrate is a white, deliquescent powder, c and of a cooling, alkaline taste. It is soluble in two water and insoluble in alcohol. Its dose is from (0.3–1.5 gm.).

| Preparation. | Dose. |
|---|---|
| Lithii Citras Effervescens, U. S. P. . . . . | 1–2 dr. (4.0–8.0 |

Lithium citrate is the therapeutic equivalent of lithi bonate, and may be substituted for the latter when a is preferred to a powder.

### LITHII BENZOAS, U. S. P.

(Lithium Benzoate; $LiC_7H_5O_2$.)

Lithium benzoate occurs in the form of a white po small shining scales, permanent in the air, odorless, cooling, sweetish taste. The dose is from 5–30 gr. gm.).

This drug was recommended in the treatment of the ground that it would prove especially active as a solvent, the acid radical uniting with proteid deriva form the soluble hippuric acid, and the basic radical with free uric acid to form a readily soluble urate. T soning, however, has been shown to be fallacious b studies on uric acid formation and elimination, and, mor practice, lithium benzoate has been found to be less eff in gouty conditions than the other salts of lithium.

## OTHER DIURETICS.

**Calomel** (see p. 330).—Several theories have been a to explain the diuretic action of this drug; the most one is that it acts directly on the renal epithelium. It cially useful in the *dropsy of cardiac disease*, but it is n

out value in serous effusions of hepatic or renal origin. A few large doses (2–3 gr.—0.13–0.2 gm.) may be given, opium being added, when necessary, to prevent purging; or small doses (¼ gr.—0.016 gm.) may be employed as adjuvants to digitalis and squill.

**Spirit of Nitrous Ether** (see p. 262).—Sweet spirit of niter is an agreeable remedy of feeble diuretic power. Each of its components—ethyl nitrite, ether, and alcohol—probably contributes to its activity. It is useless in general dropsy, but it is very efficacious in relieving *oliguria* that is due to *febrile disease* or *active congestion of the kidneys*. The usual dose as a diuretic is from 1–2 fl. dr. (4.0–8.0 c.c.).

*Incompatibles.*—Spirit of nitrous ether is incompatible with antipyrin, iodids, ferric sulphate, tincture of guaiacum, mucilage of acacia, and tannic acid.

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## STIMULANTS TO THE GENITO-URINARY TRACT.

Under this heading will be considered those drugs that stimulate the mucous membrane of the whole genito-urinary tract. All these act also upon the secretory cells of the kidneys, and increase more or less the quantity of urine, but this influence is subordinate to that exerted upon the mucous membranes over which the urine flows. Many of them contain antiseptic principles that are eliminated by the kidneys, and that are powerful enough to inhibit the growth of bacteria and to prevent decomposition of the urine. In large doses these drugs are capable of producing acute inflammation of the bladder and urethra, and even of the kidneys themselves.

The most important members of this group are:

| | |
|---|---|
| Copaiba. | Oil of erigeron. |
| Cubeb. | Buchu. |
| Matico. | Uva ursi. |
| Oil of sandalwood. | Chimaphila. |
| Turpentine. | Pareira. |
| Juniper. | Cantharides. |

The combined stimulant and antiseptic properties of these drugs make them useful remedies in subacute and chronic pyelitis, cystitis, and urethritis. They are contraindicated when the inflammation is of an acute character.

## COPAIBA, U. S. P.

(Balsam of Copaiba; Copaiva.)

Copaiba is the oleoresin of *Copaiba Langsdorffi* and other species of *Copaiba*, a small tree growing in the northern states of South America. It is a yellowish or brownish viscid liquid, having a peculiar, aromatic odor and a bitter, acrid taste. It contains a volatile oil (40.9 per cent.), resins, a bitter principle, and copaivic acid. The dose of copaiba is from 5–30 min. (0.3–2.0 c.c.) in capsule or emulsion.

| PREPARATION. | DOSE. |
|---|---|
| Oleum Copaibæ, U. S. P. . . . . | 5–15 min. (0.3–1.0 c.c.). |

**Physiologic Action and Therapeutics.**—In therapeutic doses copaiba acts as a stimulant to mucous membranes. As its active principles are eliminated chiefly by the kidneys and lungs, it particularly influences the mucous membrane of the genito-urinary tract and bronchi. The drug also excites diuresis, and imparts to the urine decided antiseptic properties. The resins and most of the oil are excreted by the kidneys, but a part of the oil escapes through the lungs and skin. The oil appears in the urine in part unchanged, and in part in combination with glycuronic acid. Urine containing the resins of copaiba responds to the nitric acid test for albumin, but the resinous precipitate can be distinguished by its rapid disappearance on the addition of alcohol. Fehling's solution may also be reduced by urine containing the educts of copaiba. In large doses copaiba acts as an irritant, causing burning in the stomach, vomiting and purging, lumbar pains, frequent micturition, and even strangury. In some persons the administration of the drug is followed by an eruption on the skin, urticarial, scarlatinoid, or morbilliform in type.

In inflammatory diseases of the genito-urinary tract, such as *pyelitis*, *cystitis*, and *urethritis*, copaiba is a useful remedy; it should not be used, however, until the most acute symptoms have subsided. In *gonorrhea*, after the discharge has become well established, the drug affords considerable relief and tends to prevent complications. It may be combined advantageously with other drugs, like cubeb and salol, which tend to render the urine sterile. As a simple diuretic it has been well recommended in *dropsy* due to *cirrhosis of the liver*. In *subacute and chronic bronchitis* with profuse purulent expectoration it is sometimes beneficial, but generally it is less useful than oil of eucalyptus

or the preparations of guaiacol. Copaiba has a long-standing reputation as a stimulant application for *indolent ulcers*.

Both copaiba itself and the oil are eligible preparations. On account of their unpleasant taste they should always be prescribed in capsules or as an emulsion.

## CUBEBA, U. S. P.

(Cubeb.)

Cubeb is the unripe fruit of *Piper Cubeba*, a perennial climber indigenous to Borneo and the neighboring islands. It contains a volatile oil (5–15 per cent.), a resin, cubebic acid, and cubebin, which is inert. The dose of powdered cubeb is from ½–2 dr. (2.0–8.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Cubebæ, U. S. P. . . . . | 10–30 min. (0.6–2.0 c.c.). |
| Oleoresina Cubebæ, U. S. P. . . . . | 5–15 min. (0.3–1.0 c.c.). |
| Oleum Cubebæ, U. S. P. . . . . | 5–15 min. (0.3–1.0 c.c.). |
| Trochisci Cubebæ, U. S. P. (each contains about ¼ gr. (0.02 gm.) of oleoresin) . . . | 1–5 troches. |

**Physiologic Action and Therapeutics.**—Cubeb possesses properties closely resembling those of copaiba; hence it may be employed to meet the same indications as the latter. A combination of the two is often more effective than either alone. Cubeb is somewhat less liable than copaiba to disturb digestion or to cause cutaneous rashes. Troches of cubeb are useful in relieving hoarseness and fatigue of the larynx resulting from prolonged use of the voice. The oleoresin is the most active preparation; it should be given in capsules or as an emulsion.

## MATICO, U. S. P.

Matico is the leaves of *Piper angustifolium*, a shrub growing in Mexico and South America. It contains a volatile oil, a resin, tannin, and artanthic acid.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Matico, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |

**Physiologic Action and Therapeutics.**—Matico somewhat resembles cubeb in its action, and has been given in the same class of cases. The leaves, on account of their hairy surfaces, favor coagulation and arrest bleeding when applied to small wounds. The drug is rarely employed at the present time.

## OLEUM SANTALI, U. S. P.

(Oil of Santal; Oil of Sandalwood.)

Oil of santal is a volatile oil distilled from the wood *talum album*, a small tree growing in India and the Ea Islands. It is a thick, pale-yellow liquid, having a str matic odor and a pungent, spicy taste. It is soluble in The dose is from 5–20 min. (0.3–1.2 c.c.), in capsules emulsion.

Oil of santal resembles copaiba in its action, bu irritant.

## TEREBINTHINA, U. S. P.

(Turpentine.)

Turpentine is a concrete oleoresin obtained from *Pin tris* and other species of *Pinus* growing in the Souther States, especially in North Carolina. When subjecte tillation it yields a volatile oil, *oleum terebinthinæ*, an residue, *resin*.

### OLEUM TEREBINTHINÆ, U. S. P.

(Oil of Turpentine; Spirit of Turpentine.)

Oil of turpentine is a limpid, colorless, highly infl liquid, having a characteristic odor and taste. It con eral terpene hydrocarbons. The rectified oil is mac tilling the ordinary oil with lime-water, and is the pr always selected for internal use.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Terebinthinæ Rectificatum, U. S. P. . | 5–20 min. (0.3–1. |
| Emulsum Olei Terebinthinæ, U. S. P. (15 per cent.) . . . . . | ½–2 fl. dr. (2.0–8.0 |
| Linimentum Terebinthinæ, U. S. P. (oil of turpentine, 35 ; resin c | |

*Terpin hydrate* (see p. 289) is a crystalline compound obtained action of oil of turpentine, alcohol, and nitric acid.

*Terebene* (see p. 288) is a liquid hydrocarbon made by oxidizing tine with strong sulphuric acid.

**Physiologic Action.**—When applied to the sk turpentine acts as an irritant, producing redness and and, if the contact be prolonged, vesication. The decided antiseptic properties, and is capable, even form, of preventing fermentation and putrefaction. I in full doses, it causes a sense of warmth in the stoma ened respiration, and an increase in the rate and tens pulse. It escapes from the body through the respira and the kidneys, and imparts to the urine an agree

resembling that of violets. In overdoses it produces abdominal pain, nausea, vomiting, embarrassed respiration, a rapid, feeble pulse, great muscular relaxation, lumbar pains, dysuria, scanty bloody urine, delirium, and finally coma.

In therapeutic doses oil of turpentine acts as a circulatory stimulant and diuretic. In the alimentary canal it plays the part of a carminative and an antiseptic. On leaving the body it imparts its peculiar stimulant and antiseptic properties to the urine and the secretions of the respiratory tract. In susceptible persons an erythematous or papular eruption may result from either its internal or its external use.

**Therapeutics.**—Externally oil of turpentine is used as a rubefacient in various inflammatory affections, such as *bronchitis, pleurisy, pneumonia, gastritis,* and *enteritis.* It is best applied in these cases in the form of a stupe made by sprinkling freely with the oil a piece of flannel which has first been soaked in boiling water and then wrung dry. It may be allowed to remain on the affected part from ten to twenty minutes, according to the sensitiveness of the skin. Turpentine liniment makes an excellent application in *muscular rheumatism* and *chilblains.*

Oil of turpentine is a reliable carminative, and may be administered either by the mouth or by the rectum. Troublesome *tympanites* will often yield to the application of a stupe to the abdomen and the rectal injection of a pint of soapy water containing a tablespoonful of the oil.

The oil is a valuable adjunct to alcohol in certain cases of *typhoid fever.* It is useful when the tongue is dry, brown, and fissured; when there is a tendency to muttering delirium; and when there is marked abdominal distention. It sometimes acts favorably as a stimulant and antiseptic in subacute and chronic inflammations of the genito-urinary tract, such as *cystitis* and *urethritis.* It may be employed as an expectorant in *subacute and chronic bronchitis,* when the expectoration is copious and purulent, but generally terebene will be found more agreeable. With some practitioners it has acquired a reputation as a hemostatic in *passive hemorrhage* from the stomach, intestines, lungs, or kidneys. Some cases of *purpura hæmorrhagica* are favorably influenced by the oil.

Oil of turpentine, ½–1 fl. oz. (15.0–30.0 c.c.), with castor oil, has been used as an anthelmintic to destroy *tape-worm,* but there are other remedies equally effective and decidedly less dangerous.

A mixture of 3 parts of oil of turpentine and 2 of ether, on

the recommendation of Durande, of Dijon, was at c
largely employed as a solvent of gall-stones, but it h
abandoned from the lack of evidence as to its efficacy.

Oil of turpentine is a powerful deodorant. In the
vapor it may be employed to overcome the fetid odc
breath in *bronchiectasis* and *gangrene of the lung*. It is
able for removing the odor from the hands after pos
examinations. Madden has found it efficacious in de
the offensive character of the discharges in *cancer of th*
He recommends a douche composed of a tablespoor
of the oil and magnesia to a quart of boiling water;
ture is to be cooled and thoroughly stirred before bei
The penetrating odor of iodoform is lost to a great
the presence of turpentine.

Whatever may have been the merits of old prepar
the oil in *phosphorus-poisoning*, it is certain that the
article of commerce is entirely without efficacy.

**Contraindications.**—It should not be prescrib
there is acute inflammation of the stomach, intes
genito-urinary tract.

**Administration.**—Oil of turpentine may be adm
on lumps of sugar, in capsules, or in emulsion.

**Incompatibles.**—Bromin, iodin, nitric acid, and st
phuric acid act with violence on oil of turpentine.

### RESINA, U. S. P.

(Rosin; Resin; Colophony.)

Rosin is the hard, transparent, amber-colored re
after distilling off the volatile oil from turpentine.

PREPARATIONS.

Ceratum Resinæ, U. S. P. (rosin, 35 parts; yellow wax, 15 part
50 parts).

Ceratum Resinæ Compositum, U. S. P. (rosin, 22.5 parts; yello
22.5 parts; suet, 30 parts; turpentine, 11.5 parts; linseed
parts).

Emplastrum Resinæ (rosin, 14 parts; lead-plaster, 80 parts;
wax, 6 parts).

**Therapeutics.**—Rosin cerate and compound ro
are chiefly employed as stimulating applications fo
*ulcers*. Rosin plaster is no longer official, rubber
plaster (*Emplastrum Adhæsivum*) having been subst
it. As it is less irritating to the skin, however, than t
adhesive plaster, it is to be preferred to the latter for

the chest in fracture of the ribs and in pleurisy, and for making compression over indolent leg-ulcers.

## JUNIPERUS.

(Juniper.)

Juniper is the fruit of *Juniperus communis*, an evergreen shrub growing in Northern Europe, Asia, and America. It contains a volatile oil, resin, and a non-crystalline principle, juniperin.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Juniperi, U. S. P. | 3–5 min. (0.2–0.3 c.c.). |
| Spiritus Juniperi, U. S. P. (5 per cent. of oil of juniper) | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Spiritus Juniperi Compositus, U. S. P. (equivalent to gin) | 1–4 fl. dr. (4.0–15.0 c.c.). |

**Physiologic Action and Therapeutics.**—Juniper is a more active diuretic than most of the stimulants to the genito-urinary tract. The compound spirit is useful in increasing the flow of urine in *passive congestion of the kidneys* resulting from chronic heart disease. Its combination with a vegetable salt of potassium enhances its effect. In subacute and chronic inflammatory diseases of the genito-urinary tract it is not generally so useful as copaiba, oil of santal, or buchu.

## OLEUM ERIGERONTIS, U. S. P.

(Oil of Erigeron; Oil of Fleabane.)

Oil of erigeron is a volatile oil distilled from the fresh, flowering herb of *Erigeron canadensis*, an annual shrub growing in waste places in North America. It is a pale-yellow liquid, having a persistent aromatic odor and taste. The dose is from 5–15 min. (0.3–1.0 c.c.), on sugar, in capsules, or as an emulsion.

Oil of erigeron resembles oil of turpentine in its action, but it is less powerful. It has been used to some extent as a substitute for copaiba and oil of santal in the treatment of *cystitis* and *gonorrhea*. It has an established reputation as an *internal hemostatic* in hemorrhage from the uterus, lungs, intestines, and kidneys, especially when the bleeding is slight but persistent.

## BUCHU, U. S. P.

Buchu is the leaves of *Barosma betulina*, growing in Southern Africa. Its active principle is a volatile oil, from which is derived *barosma camphor* or *diosphenol*.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Buchu, U. S. P. . . . . | ½–1 fl. dr. (2.0–4.0 |

**Physiologic Action and Therapeutics.**—In ther doses buchu acts as a stimulant to the mucous memb the genito-urinary tract. It is a feeble diuretic. The oil is eliminated by the kidneys, and imparts to the u aromatic odor. Its presence also makes the urine n less antiseptic. Overdoses may produce vomiting, p and strangury.

Buchu is useful in the less severe forms of *subacu chronic cystitis*. It is especially efficacious in *chronic irr of the bladder*, manifested by frequent desire to urina *subacute cystitis* it may be advantageously combined alkali, as in the following formula:

℞ Fluidextracti buchu, f℥vj (22.5 c.c.);
Potassii citratis, ℥ss (15.0 c.c.);
Spiritus ætheris nitrosi, f℥j (30.0 c.c.);
Syrupi limonis, f℥ij (60.0 c.c.);
Aquæ, q. s. ad f℥vj (180.0 c.c.).—
**Sig.** A tablespoonful in water every three hours.

## UVA URSI, U. S. P.

(Bearberry.)

Uva ursi is the leaves of *Arctostaphylos Uva-ursi*, a green shrub growing in the northern parts of Europ and North America. It contains two glucosids,—*arbu ericolin*,—tannic acid, and an inert, resinous principle Its virtues depend very largely on arbutin, which app white, crystalline needles, of a bitter taste, and freely in alcohol and hot water, but sparingly soluble in col The dose of arbutin is from 2–5 gr. (0.13–0.3 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Uvæ Ursi, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 |

**Physiologic Action and Therapeutics.**—Uva therapeutic doses stimulates the mucous membrane genito-urinary tract, increases the activity of the kidn renders the urine slightly antiseptic. It is excreted kidneys partly unchanged and partly as hydroquinon uva ursi and arbutin may impart to the urine a dar color that is probably due to the presence of pigments

from the oxidation of hydroquinon. As uva ursi contains a considerable quantity (6–8 per cent.) of tannic acid, it has well-marked astringent properties. For the same reason its preparations are incompatible with spirit of nitrous ether. Uva ursi may be employed to meet the same indications as buchu, but it is generally less efficient.

## CHIMAPHILA, U. S. P.

(Pipsissewa.)

Chimaphila is the leaves of *Chimaphila umbellata*, a perennial indigenous to North America, Northern Europe, and Northern Asia. It contains tannic acid, arbutin, ericolin, urson, and a neutral, crystalline principle, *chimaphilin*.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Chimaphilæ, U. S. P. . . . | ½–1 fl. dr (2.0–4.0 c.c.). |

Chimaphila has the same action and uses as uva ursi.

## PAREIRA, U. S. P.

(Pareira Brava.)

Pareira is the root of *Chondrodendron tomentosum*, a climbing tree growing in Brazil and Peru. It contains tannic acid and an alkaloid, *buxin*.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Pareiræ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |

Pareira has been used in the same class of cases as buchu.

## CANTHARIS, U. S. P.

(Cantharides; Spanish Flies.)

Cantharides (see p. 440) in moderate doses is an active stimulant to the mucous membrane of the genito-urinary tract. In large doses it is a powerful irritant, causing intense abdominal pain, vomiting and purging, frequent micturition, dysuria, priapism, and scanty, albuminous, and at times bloody urine. The tincture, in doses of from 1–3 min. (0.06–0.2 c.c.), has been used with advantage in certain cases of *chronic parenchymatous nephritis*. The greatest caution, however, must be exercised in

in its administration, since if there be any remnant of a inflammatory process, or if the drug be used too freely, harm may ensue. Henderson claims to have used can successfully in a case of persistent *hematuria*, in whic remedies had been tried without avail. The drug has a recommended in *chronic pyelitis*, *cystitis*, and *urethritis*.

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## SEDATIVES TO THE GENITO-URINA TRACT.

Certain drugs play indirectly the part of sedatives genito-urinary tract by removing the causes of i Thus, the alkaline diuretics afford relief from dysu frequent micturition, when these symptoms are due cessive acidity of the urine. Mineral waters, throu diluent action, soothe the mucous membrane when calculi are present. Again, boric acid, salol, and u through their antiseptic and acidifying properties, sub distressing symptoms resulting from ammoniacal ferm of the urine. But apart from these drugs, which all tion by changing the character of the urine, there ar which exert a direct sedative influence on the urinary themselves. In this class are belladonna (see p. 75), amus (see p. 81), and perhaps zea. These remedies employed for their sedative effect when there is acute mation or excessive irritability of the bladder or ureth

### ZEA, U. S. P.

(Corn-silk.)

Zea is the styles and stigmas of *Zea Mays*, or Ind Its active constituents are a resin and *maizenic acid*.

| Preparations. | Dose. |
|---|---|
| Fluidextractum Zeæ . . . . . | ½–2 fl. dr. (2.0–8.0 c |
| Decoctum Zeæ (5 per cent.) . . . . . | 1–2 fl. oz. (30.0–60.( |

**Physiologic Action and Therapeutics.**—Corn as a feeble diuretic and as a sedative to the mucous m of the genito-urinary tract. It is very useful in *acu* and in the various forms of *vesical irritability*.

# URIC-ACID SOLVENTS.

Under this heading will be considered certain drugs that are employed to prevent the precipitation of insoluble urates in the body, or to effect the solution of uratic concretions that have already been formed. The *alkalis* and the *alkaline mineral waters* were among the first agents to be used for these purposes. That these remedies are often beneficial in gout cannot be denied, but that they owe their efficacy to a solvent action is exceedingly doubtful. Uric acid does not, as was formerly supposed, exist as such in the blood or tissues, but is present in the blood chiefly as a soluble quadriurate, and in the tissues as a solid and stable biurate. The only way in which alkalis could affect the quadriurate in the blood would be by hindering its conversion into the insoluble biurate, but there is sufficient experimental evidence to show that these remedies have no such retarding effect. Nor can it be assumed that their usefulness depends upon their influence on the alkalinity of the blood, for it has been shown by Klemperer, Magnus-Levy, and others that the alkalinity of the blood in gout is very little, if at all, diminished, and that, moreover, considerable variations in alkalinity are met with in health.

We are able, by the administration of alkalies, to keep the uric acid in the urine from precipitating, and possibly to redissolve uric-acid gravel. This is accomplished, according to von Noorden, even with a urine that is still weakly acid, by the removal of the monophosphate of sodium, which, in particular, renders the urine insolvent, the biphosphate of sodium remaining as an active solvent. There is, however, very little evidence to support the belief that uratic deposits in the tissues or well-formed calculi in the pelvis of the kidney or bladder can be redissolved by the administration of alkalis. Finally, it has not been proved that the constitutional symptoms of gout, which are so often ameliorated by alkaline medication, are due to the formation of uric acid; on the contrary, there is much testimony to substantiate the view that uric acid itself is not peculiarly toxic. Until we possess a more complete knowledge of the pathogenesis of gout, no adequate explanation of the favorable action of the alkalis can be given. Doubtless much of the good that accrues to gouty patients from sojourns at watering-places is to be attributed to strict regimen, temperate living, agreeable exercise in the open air, and the liberal use of pure water, rather than to the specific action of any salts that may be contained in the waters.

Knowing that *benzoic acid* was eliminated in the urine chiefly

as the soluble hippuric acid, Ure assumed that the drug would be efficacious as a uric-acid solvent in gout and nephrolithiasis. In consequence, the acid itself and its salts have been repeatedly recommended in these conditions. But the assumption is opposed to the results of more recent investigations, which have shown that the hippuric acid is formed in the kidney, and not in the blood, and, moreover, that its formation is not attended by a corresponding decrease in the excretion of uric acid.

**Piperazin,** or **diethylendiamin,** has been highly recommended for its solvent effects in gout and nephrolithiasis, but in the experience of many observers it has proved to be entirely inert. It is prepared by the action of ammonia on ethylene bromid or chlorid, and appears as colorless, acicular crystals, very hygroscopic, and freely soluble in water. Its dose is from 5–10 gr. (0.3–0.65 gm.), well diluted. The only appreciable effect of such doses is a moderate increase in the quantity of urine. The excretion of uric acid, even in the presence of gouty concretions, is not increased. Large doses may cause nausea, malaise, stupor, muscular weakness, tremors, and incoordination. Solutions of 1 or 2 per cent. in normal urine will readily dissolve fragments of uric acid calculi in the test-tube, but the amount of unoxidized piperazin appearing in the urine after ordinary doses have been administered by the mouth has been shown to be without solvent action. Gouty tophi have been removed by the local injections of the drug, but the treatment is said to be very painful. *Lycetol,* or dimethylpiperazin tartrate, and *lysidin,* made by the interaction of ethylendiamin hydrochlorid and sodium acetate, are claimed to be more powerful solvents of uric acid than piperazin.

Tunnicliffe and Rosenheim believe that the *tartrate of piperidin,* a derivative of piperin, in doses of 15 grains (1.0 gm.), is an excellent solvent of gouty concretions. Weiss, Frankel, Ewald, and others have recently advocated the use of quinic acid, in combination with lithium (urosin) or with piperazin (sidonal). According to Weiss, quinic acid decreases the amount of uric acid in the urine, hippuric acid appearing in its stead.

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## APHRODISIACS AND ANAPHRODISIACS.

**Aphrodisiacs** are agents which stimulate the sexual appetite and increase the virile power. Sexual impotence results from a variety of causes; in consequence its treatment, to be successful, must vary accordingly. In one instance the symptom is due to diabetes, in another to locomotor ataxia, and in

still another to neurasthenia. The last is by far the most common cause of acquired impotence, and its diverse etiology must be carefully considered in formulating any special line of treatment. General hygienic measures should never be neglected. Judicious physical exercise, fresh air, and careful feeding are necessary to improve the nutritive functions. Abstinence from all sexual excitement is absolutely essential. Iron and arsenic are indicated when there is anemia. Hydrotherapy, massage, and electricity are valuble adjuvants in the treatment. Electricity, locally applied, often proves especially effective. A large electrode—the positive—should be applied over the lumbar spine, while the negative electrode is applied over the spermatic cord or perineum. A current of from 5 to 10 milliampères is sufficient. Hirt has repeatedly seen good effects follow the introduction of a metal-tipped sound into the urethra as far as the fossa navicularis, while the positive pole (anode) is placed over the lumbar cord, the current at the negative pole being made and broken several times. In many instances the psychic element is the all-important factor, and when such is the case, treatment must be directed to the mind rather than to the body. Advice calculated to promote confidence, to give encouragement, and to distract the patient's thoughts from his infirmity will be the most effectual.

The chief drugs for which special aphrodisiac action has been claimed are:

| | |
|---|---|
| Nux vomica. | Cantharides. |
| Phosphorus. | Yohimbin. |

In certain cases of impotence *nux vomica* proves very useful, not only through its general tonic influence, but also through its stimulant action on the sexual centers of the spinal cord.

*Phosphorus* is generally believed to possess the power of improving the nutrition of the central nervous system, and, in consequence, to be of value in the various manifestations of nervous exhaustion. Whether this be true or not, small doses of phosphorus are often beneficial in sexual neurasthenia. The drug may be prescribed as phosphorus in doses of from $\frac{1}{100}$–$\frac{1}{50}$ gr. (0.00064–0.0013 gm.), or as phosphid of zinc, in doses of from $\frac{1}{20}$–$\frac{1}{10}$ gr. (0.003–0.006 gm.).

*Cantharides* in large doses, by irritating the bladder and urethra, sometimes induces sexual emotions and erections, but in doses that can be regarded as safe the drug is entirely without aphrodisiac influence.

*Yohimbin* is an alkaloid or a mixture of alkaloids obtained

from the bark of the cameroon tree—johimbehe. Acc
to Löwey, it stimulates the sexual appetite and prod
marked congestion of the testes. The dose is from $\frac{1}{1}$
(0.005–0.01 gm.). Berger and Eulenberg have empl
with asserted excellent results in sexual neurasthenia.
koff, however, who has very recently made a careful st
yohimbin, finds that the congestion of the sexual or
not due to any specific action of the drug, but to its
vasodilating effect, and that while it possesses no aphr
influence, it is, in the doses recommended, distinctly to

*Orchitic and ovarian extracts*, when first introduced,
for a time the reputation of being aphrodisiacs.

**Anaphrodisiacs** are drugs which allay sexual desire
most important members of this group are:

| | |
|---|---|
| Hyoscin. | Camphor. |
| Bromids. | Lupulin. |

Anaphrodisiacs are useful in satyriasis, nymphomani
matorrhea, priapism, and chordee. Hyoscin and the
are the most reliable of all drugs for subduing morbid
bility of the genital organs. Camphor in itself is of littl
but the monobromated camphor is often efficacious.

Spermatorrhea and impotence are not infrequently as
symptoms in neurasthenia, and when such is the case
aphrodisiac, such as hyoscin, may be given at bedtime
come the irritable weakness of the sexual apparatu
general roborant measures are employed to combat the
exhaustion. In some instances seminal incontinenc
result of a local cause, such as persistent constipation,
rhoids, prostatic hypertrophy, phimosis, extreme sensi
the prostatic urethra, or loading of the urine with
of uric acid or calcium oxalate. It is needless to
under these circumstances the removal of the local
is of paramount importance. The local application
water, or even of ice, avoidance of stimulating food,
on a hard mattress without too much covering, the ad
of some mechanical device to prevent the patient from
on his back, are measures calculated to lessen the s
of the genital organs. When the emissions occu
morning and are excited by distention of the bladde
good plan to have the patient form the habit of voi
urine at 1 or 2 o'clock in the morning.

# EMMENAGOGUES.

Emmenagogues are remedies that promote the menstrual flow. They may act indirectly by removing the remote pathologic cause of amenorrhea, or they may act directly by stimulating the uterus itself. There are very few indications for the employment of direct emmenagogues. In a large class of cases the suppression of the menstrual flow is dependent upon some general cause which has resulted in constitutional enfeeblement; thus it may be due to anemia, persistent constipation, tuberculosis, Bright's disease, extreme obesity, or myxedema. In such cases treatment should be directed to the primary disease, there being rarely any indication to address remedies to the amenorrhea as such. In conjunction with measures calculated to improve the general nutrition *iron* will be found efficacious in chlorosis, purgatives, especially *aloes*, when there is obstinate constipation, and *thyroid extract* when myxedema is the primary factor. In some cases absence of menstruation is dependent upon a pronounced defect in the development of the genital organs or upon atresia of the genital passages. Under such circumstances, emmenagogues would, of course, be of no avail. Again, amenorrhea may be a symptom of uterine or ovarian disease, and when such is the case, it is manifestly improper to goad the affected organs with stimulating drugs. Occasionally suppression is associated with some psychic disturbance, such as grief, anxiety, or fear. In these cases restoration of the catamenia usually occurs after a time without recourse to special medication. Acute suppression from exposure to cold should be treated by rest in bed, hot sitz-baths, hot drinks, and hot applications to the abdomen and genitals. Constipation should be relieved by a laxative dose of aloes, and febrile reaction controlled with such remedies as aconite or spirit of nitrous ether.

The only indications for treating amenorrhea as such by the use of direct uterine stimulants are: (1) When the suppression itself is the cause of painful symptoms—that is, when there is a menstrual molimen without bloody discharge; (2) when the menses do not return upon the restoration of the general health, as is sometimes the case in girls during the developmental period.

The following drugs are the most important direct emmenagogues:

| | |
|---|---|
| Salts of manganese. | Myrrh. |
| Apiol. | Pennyroyal. |
| Senecio. | Tansy. |
| Cantharides. | Savine. |
| Oxalic acid. | Rue. |

Pulsatilla.

In addition to these drugs, *electricity*, particularly fa locally applied, has been highly extolled as a direct stimulant in amenorrhea dependent upon imperfect d ment of the internal genitals or upon atrophy cau superinvolution. One pole should be applied over crum and the other above the pubes, or, better, wit uterine cavity.

## MANGANUM.

(Manganese; Mn.)

The finding of traces of manganese in the red-blo and other tissues led to the recommendation of its salt treatment of chlorosis and other forms of anemia, bu judgment of competent observers the drug is valuele hematinic. Ringer was the first to recommend potassi manganate as an emmenagogue, and there is sufficient e at present fully to establish its worth in this respect. ably acts directly on the uterus, and not indirectly thro influence exerted on the blood. It is most efficaciou given a few days before the expected menstrual pe should be prescribed in doses of from 1–3 gr. (0.065–0 in pills made with kaolin or soft paraffin, and these sh taken after meals in large drafts of water. As po permanganate is a highly irritating salt, and, moreove at once decomposed in the stomach into the black manganese, the latter preparation (Mangani Dioxidu cipitatum, U. S. P.), which is free from irritant propert be substituted with advantage. Its dose is from 2–5 0.3 gm.).

## APIOL.

Apiol is an oleoresin obtained from *Apium Petrosel* garden parsley. It is a greenish oily liquid from whicl talline stearoptene is obtained, known as *white apiol.* T of apiol is from 5–10 min. (0.3–0.6 c.c.), in capsules. given for a few days before the expected period it is reliable emmenagogue. It was formerly recommend substitute for quinin in *malaria*, but it proved to be us

## SENECIO.

(Ragwort; Life Root.)

Senecio is the entire plant of *Senecio aureus*, a perennial herb growing in the northern and western parts of the United States. In the form of a fluid extract or tincture it has been highly recommended as a corrective of *functional amenorrhea and dysmenorrhea*. Murrell compares its action to that of potassium permanganate. The dose of the fluid extract is from ½–1 fl. dr. (2.0–4.0 c.c.); of the tincture, 1–2 fl. dr. (4.0–8.0 c.c.).

## CANTHARIS, U. S. P.

(Cantharides.)

The stimulant influence of cantharides on the uterus is probably the indirect effect of its irritant action on the urinary passages. Small doses of the tincture—**1–3** min. (0.06–0.2 c.c.)—are generally prescribed in combination with other members of the same class, as in the well-known emmenagogue mixture of Dewees, which Wood regards as the most effective combination ever made in *atonic amenorrhea*. The formula of Dewees' mixture is as follows:

℞ Tincturæ ferri chloridi, ℥iij (11.0 c.c.);
Tincturæ cantharidis, ℥ss (2.0 c.c.);
Tincturæ aloes, ℥ss (15.0 c.c.);
Tincturæ guaiaci ammoniatæ, ℥iss (45.0 c.c.);
Syrupi, q. s. ad ℥vj (180.0 c.c.).—M.
Sig. A tablespoonful three times a day.

## ACIDUM OXALICUM.

(Oxalic Acid; $H_2C_2O_4 + H_2O$.)

Oxalic acid occurs as transparent, prismatic crystals of a very acid taste. It is readily soluble in water and in alcohol.

**Physiologic Action and Therapeutics.**—Oxalic acid is a powerful uterine stimulant, in full doses quite capable of exciting labor pains and of expelling the product of conception. As Poulet first demonstrated, it is an efficient emmenagogue if given in doses of ¼–⅓ gr. (0.016–0.02 gm.), thrice daily. Larger doses should not be given. Talley has reported a case of acute poisoning in an anemic girl from the administration of three doses of ½ gr. (0.03 gm.) each, at intervals of four hours. On account of its irritant properties it should be taken well diluted, after meals.

Oxalic acid is an active germicide, and its saturated solution has been highly recommended by Kelly and others as a *disinfectant for the hands*.

**Toxicology.**—The poisonous properties of oxalic not depend solely upon its corrosive action, for the oxalates may also cause death by paralyzing the cent vous system. The resemblance of the drug to Epsom s led to many fatal mistakes. When swallowed in a trated form it causes the usual symptoms of an irritant when taken in dilute form it is absorbed and induces lar weakness, cyanosis, coma, and collapse. The antidote is chalk or lime, which acts by forming an i and inert calcium oxalate. The salts of potassium and cannot be used as antidotes since they form soluble and ous oxalates.

## MYRRHA, U. S. P.

(Myrrh.)

Myrrh is a gum-resin obtained from *Commiphora M* small tree growing in eastern Africa and Arabia. It ap the form of brownish-red irregular-shaped tears, ha agreeable aromatic odor and a bitter acrid taste.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Myrrhæ, U. S. P. . . . . | 10–30 min. (0.6–2.0 |
| Tinctura Aloes et Myrrhæ, U. S. P. (10 per cent. of each) . . . . . | ½–2 fl. dr. (2.0–8.0 |
| Mistura Ferri Composita, U. S. P. (Griffith's mixture; ferrous sulphate, 6; myrrh, 18; sugar, 18; potassium carbonate, 8; spirit of lavender, 60; rose-water, to make 1000) . . | 1–4 fl. dr. (4.0–15 |
| Pilulæ Aloes et Myrrhæ, U. S. P. (aloes, 2 gr.—0.13 gm.; myrrh, 1 gr.—0.06 gm.) . . . . | 1–4 pills. |
| Pilulæ Rhei Compositæ, U. S. P. (aloes, 1½ gr.—0.1 gm.; rhubarb, 2 gr.—1.3 gm.; myrrh, 1 gr.—0.06 gm.). . . . . | 1–5 pills. |

**Therapeutics.**—Myrrh is used as an emmenag as a stimulant to mucous membranes. When employ emmenagogue, it is usually associated with iron or alo tincture, diluted with water, or with a weak solution or potassium chlorate has been extensively employ local application in *ptyalism, ulcerative stomatitis,* an *gums.*

℞ Potassii chloratis, gr. xl. (2.6 gm.);
Tincturæ myrrhæ, f℥iss (45.0 c.c.);
Tincturæ benzoinæ comp., f℥vj (24.0 c.c.);
Liquoris antiseptici, q. s. ad f℥iv (115.0 c.c.).—M.
Sig. Teaspoonful in a wineglassful of water as a mouth-wash ever

Myrrh was also used at one time as a stimulant expec *chronic bronchitis,* but it has been replaced by more remedies.

## HEDEOMA, U. S. P.

(Pennyroyal.)

Pennyroyal is the leaves and tops of *Hedeoma pulegioides*, an annual herb indigenous to North America. It contains a volatile oil, a bitter principle, and tannin.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Hedeomæ, U. S. P. | 3–10 min. (0.2–0.6 c.c.). |
| Infusum Hedeomæ | 1–2 fl. oz. (30.0–60.0 c.c.). |

**Therapeutics.**—Pennyroyal, in the form of a hot infusion, has a popular reputation as an emmenagogue which is not altogether unmerited. It is especially employed in acute suppression brought on by exposure.

## TANACETUM.

(Tansy.)

Tansy is the leaves and tops of *Tanacetum vulgare*, a perennial herb growing wild in Europe and Asia, and naturalized in North America. Its active principle is a volatile oil.

| PREPARATION. | DOSE. |
|---|---|
| Oleum Tanaceti | 1–3 min. (0.06–0.2 c.c.). |

**Physiologic Action and Therapeutics.**—Tansy has long been used as a domestic remedy in *amenorrhea*, the herb itself being generally employed in doses of from ½–1 dr. (2.0–4.0 gm.), in decoction. The oil has also been taken frequently in order to produce abortion, many times with ill success, but with grave or even fatal results to the mother. Large doses of the oil cause severe abdominal pain, vomiting, epileptiform convulsions, coma, and collapse. Tansy was formerly employed as an anthelmintic, but this use of the drug is now obsolete.

## SABINA, U. S. P.

(Savine.)

Savine is the tops of *Juniperus Sabina*, an evergreen shrub growing in northern Europe, Asia, and America. Its active constituent is a volatile oil.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Sabinæ, U. S. P. | 3–6 min. (0.2–0.4 c.c.). |
| Fluidextractum Sabinæ, U. S. P. | 5–15 min. (0.3–1.0 c.c.). |

**Physiologic Action and Therapeutics.**—The of oil of savine resembles that of oil of juniper, but it irritant. Large doses cause abdominal pain, vomiting ing, anuria, unconsciousness, and collapse. In pregnant the intoxication generally culminates in abortion. Owin fact that expulsion of the fetus does not occur until th tion of the intestinal canal and kidneys is sufficiently vi endanger life, many cases of fatal poisoning have result the use of the drug as an abortifacient. Oil of savine h borne a reputation in *amenorrhea* and in certain forms *orrhagia*, but at the present time it is rarely prescribed

### RUTA.

(Rue.)

Rue is the leaves of *Ruta graveolens*, a perennia indigenous to Southern Europe, and cultivated in this c It contains a volatile oil. Its action is similar to that o The dose of the oil is from 3–6 min. (0.2–0.4 c.c.).

### PULSATILLA.

Pulsatilla (see p. 65) has been recommended in sudd pression of menstruation induced by chill, but its us emmenagogue is superfluous.

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## OXYTOCICS, OR ECBOLICS.

Oxytocics are drugs that tend to accelerate partur increasing the expulsive force of the uterus. It is con that they may act directly by stimulating the unstriped of the uterus, or indirectly by influencing a center for contraction supposed to exist in the lumbar spinal cor chief oxytocics are:

Ergot. Hydrastis.
Quinin. Cotton-root bark
Corn smut.

*Indications.*—Oxytocics may be employed during hasten the expulsion of the fetus; at the close of prevent or to check postpartum hemorrhage; and puerperium to overcome certain forms of subinvolu

### ERGOTA, U. S. P.

(Ergot; Ergot of Rye; Secale Cornutum.)

Ergot is the sclerotium of a parasitic fungus, *Clavic purea*, which replaces the grain of common rye, *Secal*

The sclerotium represents a stage in the life-history of the fungus which is intermediate between that of the mycelium or spawn, and that of the spore-bearing thallus. Ergot is obtained principally from Russia, Germany, and Spain. The official preparation is horn shaped, about an inch (2 or 3 cm.) long, and $\frac{1}{8}$ inch (3 mm.) thick; externally it is purplish black, and internally, whitish with pinkish striæ. It has a peculiar heavy odor and an oily, disagreeable taste. The chemistry of ergot has not been definitely determined. Kobert separated in an impure state three bodies—*ergotinic acid*, *cornutin*, and *sphacelinic acid*—and subsequently Jacobj demonstrated that the activities of sphacelinic acid depended upon an unstable resinous body, *sphacelotoxin*. None of these constituents, however, represents completely the activities of the crude drug. *Ergotinic acid* is a sapotoxin. Taken by the mouth, it causes gastro-intestinal irritation, but nothing more, as it is not absorbed. Injected intravenously, it induces paralysis of the central nervous system. *Cornutin* is an alkaloid. It first stimulates and then depresses the central nervous system, particularly the medulla. Lethal doses cause restlessness, salivation, vomiting, purging, clonic convulsions, and, finally, death from asphyxia. *Sphacelotoxin* is the most important constituent of ergot. It has a fourfold action: it produces severe irritation of the alimentary canal; it causes constriction of the arterioles, extreme enough in some animals to induce gangrene of certain peripheral parts; it excites contractions in the uterus, which, if gravid, may result in abortion, and, in very large doses, it depresses the central nervous system.

| PREPARATIONS. | DOSE. |
|---|---|
| Vinum Ergotæ, U. S. P. | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Fluidextractum Ergotæ, U. S. P. | ½–1 fl. dr (2.0–4.0 c.c.). |
| Extractum Ergotæ, U. S. P. | 5–15 gr. (0.3–1.0 gm.). |
| Ergotin (Bonjean's Ergotin: a purified hydro-alcoholic extract of ergot) | 3–10 gr. (0.2–0.65 gm.). |

**Physiologic Action.**—**Circulatory Action.**—The subcutaneous injection of ergot in moderate doses is followed by constriction of the arterioles, with an increase in the arterial pressure, which is due to the stimulant effect of the drug on the vasomotor center, and probably, also, to its direct action on the muscular coats of the vessels. When the injection is made intravenously the blood-pressure is first lowered and then raised, the primary fall, according to Wood, being due to temporary depression of the heart from direct contact with the drug. After toxic doses there may be a marked and continuous fall in the blood-pressure from depression of both the vasomotor center and the heart. The

rise of blood-pressure is often accompanied by slowin heart, which seems to be due to stimulation of the ir center in the medulla. The gangrene observed in poisoning is the result of prolonged constriction of the a and the consequent formation of hyaline thrombi. the lower animals the gangrenous effect of ergot is produced in fowls and pigs, but not in cats, dogs, or r

**Nervous System.**—Ordinary doses of ergot, if not l tinued, have no appreciable influence on the nervous In one form of chronic poisoning, however, nervous ph are pronounced. These include paresthesia, anesthe vulsions, tonic contractions of the limbs, ataxia, mental and dementia. Grigorjeff has found postmortem in slowly poisoned with ergot degenerative changes central nervous system, especially in the posterior col the spinal cord.

**Alimentary Canal.**—Ergot increases the peristalti ments of both the stomach and intestine, probably thr direct action on their muscular coats. Even in th doses it may excite nausea and vomiting.

**Uterus.**—In the parturient woman small doses induce uterine contractions which often closely reser rhythmic contractions observed in normal labor. A doses, however, the contractions usually become ver ful, and uninterrupted or tetanic. The preparation drug on the market vary so much in activity that it difficult to predict the effect of an average dose in a gi The influence of ergot on the gravid but non-parturie is less marked, but there is ample evidence to sho animals it is capable of originating expulsive moveme culminate in abortion. It is not definitely known wh ecbolic action of ergot is due to direct stimulatio unstriped muscle of the uterus itself, or to an influenc on the uterine center in the spinal cord. It is pr part, at least, of peripheral origin.

**Muscles.**—On the voluntary muscle ergot has no it seems to have a stimulant influence on the in muscle throughout the body.

**Toxicology.**—In *acute ergot poisoning* the sympt commonly observed are nausea, vomiting, intense thi ness of the surface, headache, stupor, and generalized The pulse may be unduly slow, or, after very larg rapid and feeble.

*Chronic ergot poisoning* has not been uncommon. every instance it has resulted from eating bread

ergotized grain. It assumes two forms: Spasmodic ergotism and gangrenous ergotism. The first is characterized by malaise, inordinate craving for food, vomiting, diarrhea, headache, disordered vision, tinnitus aurium, formication, numbness of the extremities, ataxia, convulsive seizures, painful contractions of the muscles, and mental hebetude, followed by delirium or acute dementia.

Gangrenous ergotism is characterized by exhaustion, coldness of the surface, cyanosis, aching of the limbs, and the development of gangrenous areas in various parts of the body, especially in the fingers and toes. Cataract has also been frequently observed.

**Therapeutics.**—Ergot may be used during parturition, cautiously and in small doses, to hasten the expulsion of the fetus, when the cause of the delay is simply *uterine inertia*, and not mechanical obstruction, but it is very rarely necessary. Its use in full doses, especially when dystocia is the result of contracted pelvis, rigid os uteri, displacement of the uterus, abnormal presentation, or other physical abnormity, may prove disastrous by exciting tetanic contraction and consequent asphyxia of the child or even rupture of the uterus. At the close of labor, after the head is born, ergot is very useful in *preventing postpartum hemorrhage*. It may be used also after the removal from the uterus of any abnormal contents—retained placenta, clots, etc.—to control hemorrhage that has already occurred. It is a useful adjuvant in the treatment of certain cases of *subinvolution of the uterus*, but the possibility of its affecting the child through the mother's milk must be borne in mind. The treatment of *uterine fibroids* with repeated injections of ergot, as recommended by Hildebrandt in 1872, has met with a very limited success. By contracting the blood-vessels of the uterus, however, the drug may temporarily control hemorrhage, and in rare instances check the growth of the tumor, or even bring about its involution. The treatment is adapted only to small intramural fibroids that are soft and vascular.

While the efficacy of ergot in certain forms of metrorrhagia has been conclusively proved, there is no satisfactory evidence that the drug is of value in other forms of hemorrhage, such as hemoptysis, hematuria, or hematemesis. On the contrary, our knowledge of its physiologic action indicates that it may be productive of harm. Granting that ergot can lessen the caliber of eroded, degenerated, or seriously wounded vessels, there is no reason for supposing that its influence is restricted to the vessels concerned in the bleeding, and if such is not the

case, the universal constriction of the arterioles indu
the drug, and the consequent rise in the general bloo
ure must favor the escape of blood from the injured
and militate against the formation of an occluding th
Ergot has been used with some success in *diabetes i*
(Da Costa, Ringer), in *colliquative sweats* (Wood), and
*aches of a migraine type* (Thomson). It has also been
mended in a variety of other affections, such as diabete
tus, acute meningitis, myelitis, splenic enlargement
dysentery, and hyperemic skin diseases, but it has n
the test of experience.

**Administration.**—The preparations of ergot on the
are exceedingly variable in strength; some are ab
inert. The best preparation for internal use is a go
extract. It is less liable to excite nausea when tak
meals. In urgent cases the drug should be given h
mically, notwithstanding its tendency to produce local
mation. The injections should not be made directly
the skin, but deeply into a muscle. An aqueous sol
the extract, freshly prepared and filtered, may be er
Bonjean's ergotin is unreliable.

## OTHER OXYTOCICS.

**Quinin** (see p. 416).—This drug has some powe
creasing the rapidity and energy of the uterine con
when they have once begun; its action, however, is in
The contractions are much less prolonged than thos
by ergot, and are probably due to an influence exerted
on the uterine muscle. As the drug does not seem
of originating labor-pains, it cannot be considered a
ecbolic, and the cases of abortion that have been rep
following its administration have no doubt been due eitl
idiosyncrasy or to the original disease for which the q
prescribed. According to some obstetricians, its us
labor distinctly increases the tendency to postpartum
rhage.

**Hydrastis** (see p. 379).—Both the natural alkaloi
drug, *hydrastin*, and its artificial derivative, *hydrastim*
considerable value in controlling hemorrhage from th
It is definitely known that both drugs induce constr
the peripheral vessels, but whether their efficacy in met
is due, in part, to their power of exciting contractic
uterine muscle is a moot question. Many write
ever, maintain that these alkaloids have pronounce

properties, and are capable, in sufficient dose, of producing abortion.

As a uterine hemostatic hydrastinin is preferable to hydrastin. It is particularly efficacious in *simple menorrhagia* of young girls and in *metrorrhagia* following abortion or resulting from disease of the adnexa. Hemorrhages resulting from the presence of cancer or fibroids are not much affected by the drug. The dose of the official hydrastinin hydrochlorid is from ¼–1 gr. (0.016–0.065 gm.). When a prompt effect is required, it should be given hypodermically in the form of a 10 per cent. aqueous solution.

**Cotton-root Bark.**—This drug (*Gossypii Cortex*, U. S. P.) is said to have been much valued among the slaves of the South as an abortifacient. Some obstetricians have claimed for it an action resembling that of ergot. The dose of the fluid extract as an ecbolic is from ½–2 fl. dr. (2.0–8.0 c.c.).

**Corn Smut.**—This drug (*Ustilago Maydis*) is a fungus growing on the stems and tassels of *Zea Mays*, or Indian corn. According to some obstetricians, the fluid extract, in doses of from ½–1 fl. dr. (2.0–4.0 c.c.), induces in the parturient uterus vigorous but intermittent contractions, and is, therefore, a useful stimulant when the labor pains are feeble from exhaustion.

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## DIAPHORETICS, OR SUDORIFICS.

Diaphoretics are agents that promote the secretion of sweat. They may act by stimulating the terminations of the secretory nerves, by stimulating the cells in the central nervous system (sweat centers) from which those nerves arise, by dilating the blood-vessels of the skin, or, reflexly, by irritating peripheral sensory nerves. The activity of the sweat glands may also be increased by external heat, muscular exercise, dyspnea, strong emotion, and nausea.

Although dilatation of the cutaneous vessels promotes perspiration when other conditions are not unfavorable, the mechanism of sweat secretion is in large measure independent of the blood-flow. Thus, in fever the flushed skin may be unnaturally dry, while in collapse, with pallid skin, there may be free perspiration. External heat may act partly by inducing hyperemia of the skin, but that it acts chiefly by stimulating the sweat-fibers reflexly through the cutaneous sensory nerves appears evident from the fact that exposure of a part to a high

temperature does not cause sweating if all the nerves to the part be severed. Muscular exercise probably increasing the flow of blood to the glands and by stir the peripheral nerves and nerve-centers. Dyspnea increasing the proportion of venous blood, the latter powerful stimulant of the sweat-centers. Strong e affect secretion probably also by action on the nerve The sweating that attends nausea is, no doubt, induced by stimulation of the sweat-centers through the sensor of the stomach. Among drugs, pilocarpin owes its dia effect to stimulation of the nerve-endings in the gla while alcohol and opium favor sweating, probably by the skin vessels. The drugs most commonly empl diaphoretics are:

| | |
|---|---|
| Pilocarpus (pilocarpin). | Spirit of nitrous et |
| Opium. | Ammonium acetat |
| Ipecacuanha. | Warburg's tinctur |

**Indications.**—Diaphoretics are given: (1) To pro absorption of dropsical fluid; (2) to rid the system of matters; and (3) to arrest the development of local tions or inflammations that have resulted from exp cold.

## PILOCARPUS, U. S. P.

(Jaborandi.)

According to the Pharmacopeia pilocarpus is the l *Pilocarpus microphyllus* and of *Pilocarpus Jaboranda* growing in South America. It contains three alkalo *carpin*, *pilocarpidin*, and *isopilocarpin*—which produc effects, but pilocarpin is the most active, and is p larger quantity ($\frac{1}{4}$–$\frac{1}{2}$ per cent.) than the others. Jo recent investigation, was unable to find in the leaves a obtainable any trace of an alkaloid answering to th tion of *jaborin*, discovered by Harnack and Meyer, a is said to resemble atropin in its action.

Pilocarpin yields soluble crystalline salts, of whi trate (Pilocarpinæ Nitras, U. S. P.) and the hydrochl carpinæ Hydrochloridum, U. S. P.) are most comm ployed. The dose of either of these salts is from (0.005–0.03 gm.).

| Preparation. | Dose. |
|---|---|
| Fluidextractum Pilocarpi, U. S. P. . . . . | 20–60 min. (1.2–4 |

**Physiologic Action.—Secretion.**—The dominant action of pilocarpin is on the secretory glands of the body. Under its influence the sweat and saliva are enormously increased. It increases also, but to a less extent, the lacrimal, nasal, bronchial, gastric, and intestinal secretions. Milk, bile, and urine are not materially increased. As its effect on secretion is completely suspended by atropin, it would seem to be due to stimulation of the peripheral fibers of the nerves supplying the glands.

**Circulatory System.**—The action of pilocarpin on the circulation has not been definitely determined. In certain animals, like the frog, cat, and rabbit, it appears first to stimulate and then to depress the peripheral fibers of the vagus, in consequence of which the pulse is primarily slowed and then quickened. After large doses the pulse again becomes slow, and the blood pressure falls considerably below normal, owing to weakness of the heart and vasomotor center. In man the circulation appears to be affected in a somewhat different manner; the pulse-rate is usually increased, the peripheral vessels are dilated, and the blood pressure is lowered. Not infrequently, however, there is a distinct rise in the arterial pressure, especially at first. Although the evidence, derived from experimental sources, is in some respects contradictory, clinical experience is in accord with the view that pilocarpin, at least in full doses, is a circulatory depressant.

**Nervous System.**—In therapeutic doses pilocarpin has no action on the central nervous system. In certain animals toxic doses induce convulsions which are probably of spinal origin.

**Respiration.**—Small doses are without effect; toxic doses depress the respiratory center. In the presence of a weakened circulation the drug tends to induce pulmonary edema.

**Muscles.**—Pilocarpin excites contractions in the unstriped muscle of the iris, stomach, intestines, bladder, uterus, and spleen, probably by stimulating the terminations of the nerve-fibers supplying the muscle.

**Alimentary Canal.**—Nausea and vomiting are sometimes induced by jaborandi or pilocarpin, especially when the drug is given by the mouth. This effect is probably caused by its irritant action on the peripheral nerves of the stomach. It also increases both gastric and intestinal peristalsis.

**Eye.**—Pilocarpin, especially when applied locally, contracts the pupil by stimulating the terminal filaments of the oculomotor nerve. It also decreases the intra-ocular tension.

**Blood.**—It has been shown that pilocarpin, probabl some influence exerted on the spleen and lymphatic g increases the lymphocytes of the blood.

**Temperature.**—Coincident with the profuse diapl which the drug excites, and probably dependent upon it is a well-marked fall in the body-temperature.

**Toxicology.**—The chief phenomena of pilocarpin p ing are salivation, profuse sweating, nausea and vo serous purging, contraction of the pupils, muscular tr and collapse. Atropin is an effective physiologic antid

**Idiosyncrasy and Untoward Effects.**—The act pilocarpin in man is by no means constant. Occasionall small doses are followed by severe cardiac depression monary edema. Swelling of the salivary glands, profu vation, and strangury have also been observed after its a tration. On the other hand, there may be a peculiar ceptibility to its action, as in a case reported by Hare, in a woman of thirty years received $\frac{3}{4}$ gr. (0.05 gm.) of pil hydrochlorid hypodermically in half an hour witho effect. According to Ringer, children are far less susc than adults.

**Therapeutics.**—Pilocarpin in doses of from $\frac{1}{16}$– (0.004–0.005 gm.) is very useful in promoting modera phoresis in *acute and chronic parenchymatous nephri* tends to avert uremia by relieving the congestion of the k and by ridding the blood of poisonous matters. Its should be supplemented by external heat, and any dep or faintness should be combated with strychnin or an The remedy may be repeated every other day or ever day. Samuel West believes that there is no more usef in *chronic interstitial nephritis* than pilocarpin in smal by the mouth. He finds that headache, irritability, d disturbances, and dry skin often yield rapidly to a dose In *acute uremia* larger doses, $\frac{1}{6}$–$\frac{1}{3}$ gr. (0.01–0.02 gm.) employed in conjunction with hot-air or vapor bat *puerperal eclampsia* the drug is very often badly bor *general dropsy*, especially that due to Bright's diseas carpin is a valuable aid to absorption. In local effusion ever, such as occur in the pleura and pericardium, it i effective. It is sometimes employed for its diaphoreti in *muscular rheumatism*, *acute coryza*, and *acute sthen tions.*

Daily injections of pilocarpin ($\frac{1}{6}$ gr.—0.01 gm.), as f ployed by Politzer in 1880, have given gratifying re

some forms of *acute and subacute labyrinthine disease*, characterized by deafness, tinnitus aurium, and vertigo.

The action of pilocarpin on the eye is much like that of eserin, but it is decidedly less powerful. It has been used to lessen intra-ocular tension in *glaucoma*, but eserin is more reliable. When, however, a gentle but persistent stimulant effect on the ciliary muscle is desirable, as in cases of *accommodative asthenopia*, pilocarpin will be found very serviceable. As an adjuvant to mixed treatment daily injections of pilocarpin have sometimes proved efficacious in intractable cases of *syphilitic keratitis*. There is sufficient evidence to prove that the internal administration of pilocarpin promotes the growth of hair, and at the same time renders it darker and coarser. Favorable results from the hypodermic use of the drug in *extensive alopecia* and *alopecia areata* have been reported by Simon, Pick, Morris, Pringle, and others, but the practice of applying the remedy in the form of lotions to the scalp in premature baldness is of doubtful utility.

**Contraindications.**—The existence of grave cardiac or pulmonary lesions prohibits its use. Caution should be exercised in giving pilocarpin to women advanced in pregnancy, as the drug possesses some power as an abortifacient.

**Administration.**—On account of the uncertain alkaloidal strength of the fluid extract and its greater tendency to cause vomiting, one of the salts of pilocarpin is usually preferable. The latter may be given by the mouth, but when a prompt effect is desired, it should be given hypodermically. Its diaphoretic action is greatly facilitated by the application of heat to the patient. Circulatory failure should be combated with ammonia, strychnin, or alcohol, and pulmonary edema with hypodermic injections of atropin. According to Tyson, a freshly prepared infusion may be injected into the rectum with prompt results. Four ounces (120.0 c.c.) of hot water should be poured on a dram (4.0 gm.) of jaborandi leaves, and, when sufficiently cool, strained and injected.

## OTHER DIAPHORETICS.

**Opium** (see p. 91).—As a diaphoretic, opium is usually employed in the form of Dover's powder, or powder of ipecac and opium. This preparation, in doses of from 5–10 gr. (0.3–0.6 gm.), produces a mild sudorific effect, and is useful in breaking up *acute catarrhal conditions of the respiratoy organs* and in relieving so-called *muscular rheumatism*. It should be

borne in mind that large doses not infrequently cause
or even vomiting when the stomach is sensitive.

**Spirit of Nitrous Ether** (see p. 233).—Sweet sp
niter (Spiritus Ætheris Nitrosi, U. S. P.) is an alcoholic
tion of ethyl nitrite, yielding, when freshly prepared, not le
eleven times its own volume of nitrogen dioxid, the equ
of about 4 per cent. of pure ethyl nitrite. It is a clear, v
inflammable liquid, having a pale yellowish or greenish-
tint, a pleasant ethereal odor, and a sharp, burning tast
exposure to light and air it rapidly deteriorates. The d
an adult is from ½–2 fl. dr. (2.0–8.0 c.c.); for a child,
min. (0.6–2.0 c.c.).

In medicinal doses nitrous ether acts as a mild diapl
diuretic, and antispasmodic. When the patient is ke
covered after its administration, its diaphoretic effect i
pronounced than its diuretic effect, and the reverse
when the patient is lightly covered. Toxic doses p
symptoms resembling poisoning by amyl nitrite and
nitrites. Sweet spirit of niter is a useful remedy in th
*febrile affections of children;* it is best given in small
well diluted with hot water, at frequent intervals. As a
it is efficacious in relieving *oliguria* due to *fever* or *ac
gestion of the kidneys.*

**Incompatibles.**—Iodids, ferric sulphate, mucilage of
tannic acid, tincture of guaiacum, and antipyrin, acetani

**Ammonium Acetate.**—This compound is empl
the form of its official solution, the spirit of mindererus
Ammonii Acetatis, U. S. P.). According as the patient
warm or cool it acts as a feeble diaphoretic or diuretic
often used in *febrile diseases* as a vehicle for spirit of
ether or aconite. Its dose is from 1–4 fl. dr. (4.0–15.0

**Warburg's Tincture** (see p. 422).—This prepar
doses of ½ fl. oz. (15.0 c.c.) is capable of inducing
sweating. To be effective, it should be given undilut
drinks should be withheld. It has been highly comme
the *malignant types of malarial fever.*

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## ANTIHYDROTICS.

Antihydrotics are agents that check the secretion o
Theoretically, they may act by lessening the irritabilit
sweat-centers; by depressing the terminal fibers of the s

nerves, or, possibly, the secretory gland-cells themselves; or by stimulating the respiratory center. Brunton has called attention to the close relation existing between respiratory depression and the occurrence of colliquative sweats. He states that when the respiratory center is exhausted from any cause it responds less readily than the sweat-centers to the stimulating influence of venous blood, in consequence of which profuse sweating results. This teaching accords with the well-known fact that respiratory stimulants are frequently efficacious in controlling the night-sweats of phthisis. The most important antihydrotics are:

| | |
|---|---|
| Atropin. | Agaricin. |
| Sulphuric acid. | Picrotoxin. |
| Camphoric acid. | Tellurium compounds. |

Thallium acetate.

*Gallic acid*, *ergot*, and *zinc oxid* have also been employed, but they are of little value. In addition to the internal remedies, certain external applications are useful in controlling excessive perspiration; thus, sponging the surface with *vinegar* and water or a hydro-alcoholic solution of *tannic acid* or *alum* sometimes affords relief. A weak solution of *formalin*, as recommended by Hirschfeld, is a powerful antihydrotic, but its irritant effects on the eyes and respiratory tract forbid its use when the sweating is general. Recently, Strasburger has substituted for the formalin solution a dusting-powder of *tannoform*, a condensation product of tannin and formaldehyd. The application, at bedtime, of a powder composed of 1 part of tannoform to 2 parts of talcum, is said to render excellent service in preventing the night-sweats of phthisis.

In local hyperidrosis internal remedies are rarely of benefit; the best results are obtained from external applications, the most effective being dusting-powders containing tannoform, salicylic acid, or boric acid, or a pigment of formalin and alcohol.

**Atropin** (see p. 75).—This is the most powerful of the antihydrotics. It checks the secretion of the sweat-glands by paralyzing the terminations of the secretory nerves. In doses of from $\frac{1}{200}$–$\frac{1}{100}$ gr. (0.00032–0.00064 gm.) at bedtime it often effectually controls the exhausting *night-sweats of phthisis;* unfortunately, however, its repeated use is frequently attended by untoward symptoms, such as dryness of the throat, thirst, and dimness of vision. The tincture of belladonna is sometimes employed as a lotion in *local hyperidrosis* occurring about the hands and feet.

**Sulphuric Acid** (see p. 448).—Aromatic sulphuric ac
been used longer and perhaps more extensively than a
the other antihydrotics. Its power, however, compare
that of drugs more recently introduced, is very feebl
should be given in doses of from 5–10 min. (0.3–0.6
largely diluted with cool water.

## ACIDUM CAMPHORICUM, U. S. P.

(Camphoric Acid; $C_8H_{14}(COOH)_2$.)

Camphoric acid is a crystalline powder made by oxi
camphor with nitric acid. It is odorless, of a slightly
taste, soluble in 160 parts of cold water, and readily s
in alcohol and ether. The dose is from 20–30 gr. (1
gm.). On account of its sparing solubility in water it i
prescribed in powders, in capsules, or in an elixir.

**Therapeutics.**—Camphoric acid is an antiseptic an
hydrotic. As an antiseptic it has been used both inte
and externally, but in this respect it is inferior to many
drugs in common use. It is of much greater serv
checking *excessive perspiration*, but the manner of its ac
unknown. As it is rapidly eliminated in the urine it i
given about two hours before the time at which the sw
is likely to occur. Its drawback is its tendency to
nausea and vomiting.

## AGARICIN.

Agaricin is a crystalline body obtained from *Pol
officinalis*, a fungus growing on the larch tree. The f
itself (white agaric or purging agaric), although an
irritant, was recommended for excessive sweating by de
as early as 1768. Agaricin is an impure form of *aga
agaricic acid*, which appears as a white, lustrous powder,
less, almost tasteless, and slightly soluble in water and al
The dose of agaricin is from $\frac{1}{4}$–1 gr. (0.016–0.065 gm.), a
agaric acid, $\frac{1}{6}$–$\frac{1}{2}$ gr. (0.01–0.03 gm.). The latter is th
irritating and more reliable preparation.

**Physiologic Action and Therapeutics.**—When a
istered by the mouth in large doses agaricin acts as an i
and induces severe vomiting and purging. According to
meister, when it is administered to animals subcutaneou
intravenously in sufficient dose it first stimulates and
depresses the centers of the medulla oblongata, deat
mately resulting through cardiac or respiratory par
The drug is chiefly interesting to the therapeutist on ac

of its effect on the perspiration. Like atropin, it arrests the secretion of sweat probably by paralyzing the nerve-endings in the sudoriferous glands. Unlike atropin, however, it has no influence on the salivary or lacrimal secretions.

Agaric acid is preferable to agaricin, being less liable to cause nausea. As it is absorbed slowly it should be given several hours before the time of the expected sweating. It may be prescribed in the form of a pill or powder.

## PICROTOXINUM.

(Picrotoxin.)

Picrotoxin is a neutral principle obtained from fish berries—*Anamirta cocculus* and *Anamirta paniculata*, growing in India and the Malayan Islands. It is a colorless, shiny, crystalline powder, odorless, and of an intensely bitter taste. It is soluble in alcohol and in acidulous or alkaline solutions, but only sparingly so in water. The dose is from $\frac{1}{80}$—$\frac{1}{30}$ gr. (0.0008–0.002 gm.).

**Physiologic Action and Therapeutics.**—The dominant action of picrotoxin appears to be upon the centers in the medulla oblongata. In animals toxic doses produce violent clonic convulsions, acceleration of the respirations, slowing of the pulse, a marked rise in the arterial pressure, and vomiting. Death often results from asphyxia induced by the convulsive seizures.

Picrotoxin has been recommended in a variety of conditions, but it is mainly useful in controlling the *night-sweats of phthisis*. The manner of its action is unknown; but it may act indirectly, as Cushny suggests, by increasing the respirations and thus preventing the stimulant effect of partial asphyxia on the sweat-centers. As an antihydrotic it often succeeds when atropin and camphoric acid have failed. It is best given by the mouth, at bedtime, in the form of a pill or tablet.

The tincture of Cocculus indicus (*Anamirta paniculata*) is a reliable remedy for *head lice*.

## TELLURIUM.

The most important tellurium compounds from a therapeutic standpoint are the tellurates of sodium and potassium. These appear as white crystalline powders, soluble in water. The dose of either salt is from $\frac{1}{3}$—$\frac{3}{4}$ gr. (0.02–0.05 gm.).

**Physiologic Action and Therapeutics.**—In warm-blooded animals large doses of any one of the tellurium compounds cause vomiting, diarrhea, somnolence, weakening of

the reflexes, paralysis, unconsciousness, respiratory convulsions, and death. A characteristic feature of the ing is the development of a strong garlicky odor in the a few minutes after the administration of the drug. Th has been determined by Hofmeister to be due to the tion of methyl tellurid. In man full doses of sod potassium tellurate arrest perspiration, impart an all odor to the breath, and impair slightly the digestion. rium compounds undergo partial reduction in the bo according to Gies, are eliminated in the metallic form feces and as methyl tellurid in the breath, urine, feces, dermal secretions. As the antihydrotic action of tell offset by pilocarpin (Czapek and Weil), it is probably depression of the peripheral secretory nerves.

The tellurates have been recommended by Neusser, male, and Dubiquet, and others for their antihydrotic in advanced phthisis, but the garlicky odor of the breat persisting several weeks after treatment has been sus is a strong objection to their use.

### THALLII ACETAS.

(Thallium Acetate; $TlC_2H_3O_2$.)

Thallium acetate occurs in the form of white delic crystals which are readily soluble in water and alcoh dose is from 1–3 gr. (0.065–0.2 gm.) in pills.

**Physiologic Action and Therapeutics.**—A thallium possesses decided toxic properties, these manifest when its salts are administered in therapeu and for short periods. Combemale, Huchard, and have found the acetate very effective in controlling th *sweats of phthisis*. Unfortunately, however, its contin is not infrequently followed by alopecia. This untowa was observed in 8 of 34 cases in which Vossaux em as an antihydrotic. Huchard also has reported a cas baldness following the administration of a dozen pil drug should be given about an hour before the sweating, and not repeated for more than four s nights.

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## EXPECTORANTS.

Expectorants are drugs that modify the secretic air-passages, affect its quantity, and facilitate its e The exact manner of their action is obscure. Those

mote secretion and render it less viscid in character, and, therefore, more easy of removal, are generally termed *sedative expectorants.* Most of the latter are also emetics, and, no doubt, owe their power of increasing secretion very largely to their nauseating properties. As a rule, they are employed as expectorants in much smaller doses than are required to produce vomiting, but occasionally vomiting itself renders valuable service in expelling mechanically excessive accumulations of tenacious mucus from the bronchi. The increased secretion which these drugs induce may be of service in depleting the congested bronchi, in protecting their surfaces from the air, in diluting and washing out the irritant, and, possibly, in exercising a bactericidal influence. The sedative expectorants in common use are:

| | |
|---|---|
| Ipecacuanha. | Quebracho. |
| Antimony (tartar emetic). | Lobelia. |
| Apomorphin. | Potassium citrate. |

Sedative expectorants are indicated in *acute bronchitis*, particularly in the early stage, when there is hard cough with little or no sputum.

Drugs that stimulate the mucous membrane of the respiratory tract and lessen the quantity of sputum are known as *stimulant expectorants.* Some of them appear to act by imparting tone to the relaxed membrane, and others also by exercising an antiseptic influence on the secretions. The most important stimulant expectorants are:

| | |
|---|---|
| Ammonium chlorid. | Sanguinaria. |
| Ammonium carbonate. | Garlic. |
| Benzoin (benzoic acid). | Grindelia. |
| Balsam of Peru. | Creosote (guaiacol). |
| Balsam of tolu. | Tar. |
| Ammoniac. | Squill. |
| Eucalyptus. | Oil of sandalwood. |
| Oil of myrtle (myrtol). | Copaiba. |
| Senega. | Cubeb. |

Oil of turpentine (terebene; terpin hydrate).

Stimulant expectorants are indicated in subacute and chronic bronchitis, especially when there is free expectoration.

**Adjuvants to Expectorants.**—When cough is disproportionate to expectoration and is in itself a source of distress, drugs may be combined with expectorants which lessen the excitability of the respiratory center or of the afferent and efferent

nerves of lung. The most reliable drugs for this purp
*opium* (*morphin, codein, heroin*), *dilute hydrocyanic acid*,
*form, bromids, hyoscyamus*, and *cannabis indica*. Son
cough is dependent to a great extent upon excessive irri
of the fauces; if this be the case, demulcents—*licori*
*cerin, acacia*—will be found useful adjuvants. Wh
respiratory center has become weakened through pe
cough, *strychnin* will prove beneficial. The same reme
renders valuable aid when the pulmonary circulation i
gish, owing to insufficient cardiac power. When br
catarrh excites asthma, antispasmodics—*belladonna*,
*mann's anodyne, chloroform, bromids*—should be ass
with expectorants. *Lobelia* is particularly useful i
cases, because it is both an expectorant and a depress

**Administration.**—Expectorants, as a rule, ar
effective when administered by the mouth. Sometime
ever, inhalations act beneficially in allaying cough, fac
expectoration, and lessening fetor of the breath. Ex
the case of very volatile substances, it is doubtful
vapors or sprays penetrate beyond the trachea and th
bronchial divisions. There are several methods of in
intended to influence the mucous membrane of the
tory tract. The simplest plan consists in breathing
the warm vapor arising from the surface of boiling
For this purpose a volatile expectorant—compound
of benzoin, terebene, creosote—may be dropped into
mouthed jug nearly filled with hot water, and the vap
ducted to the nose and mouth through a cone made
paper or a folded napkin. Inhalations of this class ar
useful, except in acute bronchitis. More complica
somewhat more serviceable, are the various hand-h
steam atomizers designed to reduce medicated flu
nebular form. In chronic bronchitis the cold spray
advantage over the steam spray in being less relaxin
effect on the throat and trachea.

Another method of administering medicated vapo
the so-called respirator. One of the most useful of t
contrivances is the oronasal respirator devised by Dr.
Yeo, which consists of a perforated zinc mask, shap
over the nose and mouth, and held in position by tape
around the ears. This mask incloses a sponge
charged from time to time with the volatile inhalant.
(with an equal amount of spirit of chloroform), turpent
bene, eucalyptol, and menthol are the drugs most fr
used in the respirator.

The intralaryngeal injection of drugs into the trachea sometimes affords great relief in chronic bronchitis, in bronchiectasis, and even in phthisis. If they are skilfully made, they rarely excite cough or other discomfort. Some bland oil, like olive oil, is usually made the vehicle for the active drug—guaiacol (1 : 100 or 1 : 50) or menthol (1 : 50).

## SEDATIVE EXPECTORANTS.

### IPECACUANHA, U. S. P.

(Ipecac.)

Ipecac is the root of *Cephaëlis Ipecacuanha*, or of *Cephaëlis acuminata*, a perennial shrub growing in Brazil and other South American States. According to Paul and Cownley, it contains three alkaloids—*emetin*, *cephaëlin*, and *psychotrin*. The does of the powdered drug as an expectorant is from ½–2 gr. (0.03–0.13 gm.); as an emetic, 15–30 gr. (1.0–2.0 gm.).

| Preparations. | Dose. |
|---|---|
| Fluidextractum Ipecacuanhæ, U. S. P. . . . . | As an expectorant 2–5 min. (0.1–0.3 c.c.); as an emetic, 15–30 min. (1.0–2.0 c.c.). |
| Syrupus Ipecacuanhæ, U. S. P. . . . . | As an expectorant, 10–60 min. (0.6–4.0 c.c.); as an emetic, 2–4 fl. dr. (8.0–15.0 c.c.). |
| Vinum Ipecacuanhæ, U. S. P. . . . . | As an expectorant, 10–60 min. (0.6–4.0 c.c.); as an emetic, 2–4 fl. dr. (8.0–15.0 c.c.). |
| Tinctura Ipecacuanhæ et Opii, U. S. P. (1 gr.—0.065 gm.—each of ipecac and powdered opium in 10 min.—0.6 c.c.) . . . . . | 5–15 min. (0.3–1.0 c.c.). |
| Pulvis Ipecacuanhæ et Opii, U. S. P. (Dover's powder: ipecac, 1 part; powdered opium, 1 part; sugar of milk, 8 parts) . . . . . | 5–10 gr. (0.3–0.6 gm.). |
| Pilulæ Laxativæ Compositæ, U. S. P. (each pill contains aloin, ½ gr. (0.013 gm.); strychnin, $\frac{1}{120}$ gr. (0.0005 gm.; extract of belladonna, ½ gr. (0.008 gm.; ipecac, $\frac{1}{16}$ gr. (0.004 gm.); with licorice and syrup . . . . . | 1–3 pills. |

**Physiologic Action.**—Ipecac is a powerful local irritant. When rubbed into the skin it causes erythema and vesication; when applied to mucous membranes it produces redness, swelling, and an increase of secretions. In some persons the mucous membrane of the respiratory tract is so sensitive to the drug that the inhalation of an exceedingly small quantity of the powder is sufficient to excite lacrimation, sneezing, run-

ning from the nose, and asthmatic breathing. The in
of a full dose of ipecac is followed in a short time by
vomiting, and a marked increase of the secretions of th
mouth, and bronchi. These effects are due to cephaë
emetin. Both alkaloids are active emetics, but the fo
decidedly more powerful in this respect than the latte
emesis is probably of peripheral origin, though the
believed by some writers to act also on the vomiting c
the medulla.

The subcutaneous injection of a toxic dose of em
followed by nausea, vomiting, purging, and collapse
well-established clinically that small doses of ipecac p
both the cutaneous and bronchial secretions.

**Therapeutics.**—Ipecac is chiefly employed as a
expectorant, an emetic, an anti-emetic, an antidysenteri
diaphoretic.

**Expectorant.**—Ipecac is an excellent expectorant
*bronchitis* before secretion has been established. In
*bronchitis*, when the sputum is scanty and viscid, it is a
viceable. In the form of a spray the wine, diluted wi
its bulk of water, as recommended by Murrell, is oft
efficacious in "winter cough" and bronchial asthma.

**Emetic.**—Ipecac, though not very prompt in its a
a certain and safe emetic. It is especially useful in c
in whom it is frequently employed to unload the stor
irritant material. In *capillary bronchitis*, when the
become filled with mucus and asphyxia is threatene
may be given in doses sufficient to excite emesis, v
hope of forcibly expelling the secretion. In poisoni
prompt emetics, like apomorphin or zinc sulphate,
ferable.

**Anti-emetic.**—Ipecac in minute doses sometimes
in controlling *persistent vomiting* that is not depende
any organic disease of the stomach. The wine is
preparation; it should be given in doses of from ½–
(0.03–0.06 c.c.) every half-hour or hour. In some i
its efficacy is enhanced by the addition of an equal qu
the tincture of nux vomica.

**Antidysenteric.**—Ipecac has a long-standing repu
*acute tropical dysentery;* a large dose of from 30–40
2.6 gm.) should first be given to induce vomiting, a
this has occurred smaller doses of from 3–5 gr. (0.2-
should be given at intervals of two hours. To insur
tention of the latter doses, 5 min. (0.3 c.c.) of laudan
be administered fifteen minutes before each dose of ip

successful result is usually indicated by the appearance within twelve hours of copious tarry stools. In the sporadic dysentery of temperate zones this treatment is of little value.

**Diaphoretic.**—The mild and agreeable diaphoretic effect of ipecac in the form of Dover's powder has made the latter a favorite remedy in the initial stage of *acute coryza*, in so-called *muscular rheumatism*, in *influenza*, and in *acute suppression of the menses.*

**Other Uses.**—Ipecac has been recommended as a hemostatic since Trousseau's time, but its use in hemorrhage is at present obsolescent. Rutherford and Vignal concluded, from their experiments on dogs, that ipecac is a direct hepatic stimulant, but the work of other investigators has served to throw considerable doubt on this conclusion. In minute doses ($\frac{1}{8}$–$\frac{1}{4}$ gr.—0.008–0.016 gm.) it is an excellent adjuvant to strychnin in *indigestion dependent upon motor insufficiency.* In *atony of the bowel*, also, it often makes a useful addition to cathartic pills.

**Administration.**—For producing emesis either the wine or the syrup may be selected; in children the syrup, $\frac{1}{2}$–2 fl. dr. (2.0–8.0 c.c.), is preferable. Paul and Cownley recommend cephaëlin as a powerful and certain emetic, free from depressing effects when given in doses of from $\frac{1}{10}$–$\frac{1}{6}$ gr. (0.006–0.01 gm.), but it is too costly for ordinary use. The preparations and alkaloids of ipecac are all too irritating to be administered hypodermically. As an expectorant the wine, syrup, or fluid extract may be employed. A combination of ipecac with an alkaline expectorant, as in the following formula, is often effective in the first stage of bronchitis:

℞ Vini ipecacuanhæ, ℥iiss (10.0 c.c.);
Potassii citratis, ʒiij (12.0 gm.);
Tincturæ opii camphoratæ,
Syrupi acaciæ, ää ℥j (30.0 c.c.);
Aquæ, q. s. ad ℥vj (180.0 c.c.).—M.
Sig. A tablespoonful every four hours.

## ANTIMONII ET POTASSII TARTRAS, U. S. P.

(Tartar Emetic; $(KSbOC_4H_4O_6)_2 + H_2O$.)

Tartar emetic is the only official preparation of antimony. It occurs in the form of colorless crystals or a white granular powder, having a sweetish metallic taste, soluble in 15.5 parts of cold water and insoluble in alcohol. The dose as an expectorant is $\frac{1}{20}$–$\frac{1}{8}$ gr. (0.003–0.008 gm.); as an emetic, $\frac{1}{2}$–1 gr. (0.03–0.06 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Vinum Antimonii, U. S. P. (4 parts of tartar emetic in 1000). | |
| As an expectorant . . . . . | 10–20 min. (0.6–1.2 c. |
| As an emetic . . . . . | 1–4 fl. dr. (4.0–15.0 c. |
| Syrupus Scillæ Compositus, U. S. P. (0.2 per cent. with squill and senega). . . . | 5–60 min. (0.3–4.0 c. |

Tartar emetic is also contained in compound licorice r

**Physiologic Action.**—Save that it is more irritant absorbed with greater difficulty, tartar emetic, like oth monial preparations, has an action similar to that of When applied to the skin in ointment it produces vesicles, pustules, and, if the contact be prolonged, dif scesses. Taken internally in small doses ($\frac{1}{8}$–$\frac{1}{4}$ gr.—0.00 gm.) it causes nausea and some increase in the perspirat secretions of the mouth and respiratory tract. Large do gr.—0.065–0.13 gm.) produce persistent vomiting with tion, copious sweating, and marked depression. Stil doses are followed by choleraic discharges from the painful cramps, and collapse.

The emesis occasioned by tartar emetic is probably th of the direct irritant action of the drug on the stomach, some writers believe that it is partly of cerebral origi marked depression and ultimate collapse after large d due partly to the violent emesis, partly to paralysis vessels of the splanchnic area, and partly to weakenin heart itself. In fatal poisoning postmortem examinatio intense congestion of the alimentary canal with hem extravasations, and also cloudy swelling and fatty dege of the parenchymatous organs. Antimony is excrete by the stomach and bowel, but in small part by the skin, and respiratory tract.

The *treatment of antimonial poisoning* consists in the tration of tannin to form an insoluble salt, in washing stomach, and in combating collapse with diffusible sti and external heat.

**Therapeutics.**—Tartar emetic is an efficient exp in *acute bronchitis* when there is hard cough with litt expectoration. It may be prescribed conveniently in of wine of antimony, as in the following formulæ:

℞ Vini antimonii, f℥ij (8.0 c.c.);
Spiritus ætheris nitrosi, f℥j (30.0 c.c.);
Tincturæ opii camphoratæ, f℥ss (15.0 c.c.);
Liquoris potassii citratis, q. s. ad f℥iv (120.0 c.c.)
Sig. A dessertspoonful in water every two or three hours.

℞ Vini antimonii, ♏xl (2.5 c.c.);
Syrupi tolutani, f℥j (30.0 c.c.);
Liquoris ammonii acetatis, q. s. ad f℥iij (90.0 c.c.).—M.
Sig. A teaspoonful every two hours for a child of two years.

Tartar emetic was formerly used also as an emetic, a diaphoretic, circulatory depressant, and counterirritant, but for these purposes it has been almost entirely displaced by other and less poisonous remedies.

**Incompatibles.**—Tartar emetic is incompatible with tannic acid, mineral acid, alkaline carbonates, and lime water.

## APOMORPHINÆ HYDROCHLORIDUM, U. S. P.

(Apomorphin Hydrochlorid.)

Apomorphin is an artificial alkaloid obtained by abstracting from morphin a molecule of water. It is prepared by maintaining at a high temperature for several hours, in a sealed retort, a mixture (1 : 20) of morphin and strong hydrochloric acid. The hydrochlorid of this alkaloid appears as minute grayish-white, acicular crystals, having a faintly bitter taste, and acquiring a greenish tint on exposure to light and air. It is soluble in about 40 parts of water or alcohol. The dose as an expectorant is from $\frac{1}{30}$–$\frac{1}{20}$ gr. (0.002–0.003 gm.); as an emetic, from $\frac{1}{12}$–$\frac{1}{6}$ gr. (0.005–0.01 gm.).

**Physiologic Action.**—In man the subcutaneous injection of $\frac{1}{10}$ gr. (0.006 gm.) of apomorphin is followed within fifteen minutes by nausea and vomiting. The emesis is accompanied by muscular relaxation, quickening of the pulse, free perspiration, and a marked increase in the nasal, faucial, and bronchial secretions. The vomiting is of centric origin.

On the central nervous system apomorphin appears to have first a stimulant, and then a paralyzant, effect. The heart is not influenced by therapeutic doses, but toxic doses induce paralysis. The rapid pulse observed after emetic doses is due, according to Reichert, to stimulation of the accelerators.

**Therapeutics.**—Apomorphin is employed as an emetic and as a sedative expectorant.

**Emetic** (see p. 166).—The certainty and promptness of its action and its freedom from irritant properties when administered hypodermically make it almost an ideal emetic in *poisoning*, especially when swallowing is impossible or the state of the stomach is such as to forbid the use of emetics having a peripheral action. In young children and infirm subjects considerable caution must be exercised in its employment, since its action may be attended with profound exhaustion or even collapse.

**Expectorant.**—Apomorphin is a useful expectorant *acute* and *chronic bronchitis*, when the sputum is scar viscid. As it is eliminated rather rapidly, it should b at comparatively short intervals—that is, every two o hours. Apomorphin in small doses ($\frac{1}{30}$ gr.—0.002 gr also some soporific effect for which it has been es recommended in *delirium tremens*.

**Administration.**—As an emetic apomorphin sh administered hypodermically. Solutions can be conv prepared from tablets containing the requisite dose tablets and solution are liable to deteriorate with age exposure to light and air. As an expectorant it sh given by the mouth in the form of a solution, pill, or

**Incompatibles.**—Alkalis, potassium iodid and ferr rid. It is said to be incompatible also with heroin.

**Apocodein Hydrochlorid.**—This compound is p from codein after the manner of preparing apomorph morphin. It is an amorphous, yellow powder, soluble i and alcohol. It has been recommended chiefly as an e rant, in doses of from $\frac{3}{4}$–1 gr. (0.05–0.065 gm.).

## ASPIDOSPERMA.

(Quebracho.)

Quebracho is the bark of *Aspidosperma Quebracho* an evergreen tree growing in South America. It several alkaloids, the most important of which is *aspido* The aspidospermin of commerce, however, is really a of the various alkaloids, and may be given in doses $\frac{1}{2}$–1 gr. (0.03–0.065 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Aspidospermatis . . . . . | 20–60 min. (1.2 |

**Physiologic Action and Therapeutics.**—Sever alkaloids of quebracho resemble apomorphin in their that they first stimulate and then depress the central system. Like apomorphin also they induce nausea crease the secretions of the throat and bronchi. Only loid, however, is an active emetic, and that is aspi Aspidospermin in small dose is apparently an active tory stimulant.

Because of its influence on respiration and bronchi tion quebracho has been found useful in *bronchitis a with asthma or emphysema.*

### OTHER SEDATIVE EXPECTORANTS.

**Lobelia** (see p. 151).—Lobelia, like other nauseants, increases the bronchial secretions. In large dose it also depresses the fibers of the vagus distributed to the bronchial muscles. Owing to this combined action, the drug is especially valuable in *bronchitis with asthma.* The dose of the tincture of lobelia as an expectorant is from 10–30 min. (0.6–2.0 c.c.); of the fluid extract, from 2–5 min. (0.1–0.3 c.c.).

**Potassium Citrate** (see p. 228).—This and other vegetable salts of potassium are useful expectorants in the early stages of *acute bronchitis.* The citrate is generally preferred to the other salts, owing to its less unpleasant taste. It may be prescribed in doses of from 20–30 gr. (1.3–2.0 gm.), in combination with a nauseant like ipecac or antimony.

## STIMULANT EXPECTORANTS.

### AMMONII CHLORIDUM, U. S. P.

(Ammonium Chlorid; Sal Ammoniac; $NH_4Cl$.)

Ammonium chlorid is a white crystalline powder, odorless, of a cooling, saline taste, and permanent in the air. It is soluble in 2 parts of cold water and in 50 parts of alcohol. The dose is from 5–20 gr. (0.3–1.3 gm.).

PREPARATION.

Trochisci Ammonii Chloridi, U. S. P. (each contains ammonium chlorid, 1½ gr.—0.1 gm.; licorice extract, 3 gr.—0.2 gm.; with tragacanth, sugar, and syrup of tolu).

**Physiologic Action.**—The chief effect of ammonium chlorid when administered by the mouth in moderate doses is to increase and render less viscid the mucous secretion of the bronchi, and perhaps, also, of the stomach and bowel. While it lacks the stimulant influence of ammonium carbonate on the circulation and respiration, its action on the mucous membranes is much more prolonged than that of the latter salt. Very large doses have an irritant action and excite the symptoms of gastro-enteritis. Blood dyscrasia with great muscular weakness has been observed after the prolonged use of ammonium salts in large doses. Ammonium chlorid is eliminated in the urine for the most part unchanged.

**Therapeutics.**—Ammonium chlorid is particularly useful as an expectorant in *acute bronchial catarrh* after the symptoms of the initial stage have passed. It is sometimes successfully employed also in *chronic bronchitis* when the sputum is chiefly thick, tenacious mucus. In *subacute and chronic pharyngitis* or *laryngitis* lozenges of ammonium chlorid or a warm spray

of the salt (5 gr.–1 oz.—0.3 gm.–30.0 c.c.) may prov
ficial. The drug has found favor with some practitio
*subacute gastro-intestinal catarrh* and in *catarrhal jaund*

A solution of ammonium chlorid—5 gr. (0.3 gm
ounce (15.0 c.c.) each of alcohol and water—makes ar
lent lotion in *contusions with much ecchymosis.*

**Administration.**—The drug is generally given in a
solution to which licorice is added to disguise its un
salty taste. It may also be prescribed in the form
pressed tablets to be taken after meals in several ou
water:

℞ Ammonii chloridi, ℥iiss (10.0 gm.);
Syrupi scillæ, f℥v (18.5 c.c.);
Tincturæ opii deodorati, ♏ xl (2.5 c.c.);
Extracti glycyrrhizæ, ℥j (4.0 gm.);
Glycerini, f℥ss (15.0 c.c.);
Aquæ, q. s. ad f℥iv (120.0 c.c.).—
Sig. A dessertspoonful in water four times a day.

In chronic bronchitis with inspissated secretions
may be combined with ammonium chlorid, as in the f
formula:

℞ Ammonii iodidi, ℥ss (2.0 gm.);
Ammonii chloridi, ℥ij (8.0 gm.);
Syrupi pruni Virginianæ, f℥ij (60.0 c.c.);
Aquæ, q. s. ad f℥iv (120.0 c.c.).—
Sig. A dessertspoonful in water every four hours.

**Incompatibles.**—Alkalis, mineral acids, tartaric a
soluble salts of silver and lead.

### AMMONII CARBONAS, U. S. P.

(Ammonium Carbonate; $NH_4HCO_3 . NH_4NH_2CO_2$.)

The ammonium carbonate of commerce is a mixtu
monium bicarbonate (acid carbonate) and ammonium
ate. It occurs in white, translucent masses having
ammoniacal odor and a sharp saline taste. It is s
about 4 parts of cold water, and is decomposed b
water, with the elimination of carbon dioxid and a
On exposure to air it is converted into an opaque wh
der of ammonium bicarbonate. The dose is from
(0.3–0.8 gm.).

| Preparation. | Dose. |
|---|---|
| Spiritus Ammoniæ Aromaticus, U. S. P. (ammonium carbonate, 3.4; ammonia water, 9; aromatic oils; water to make 100 parts) . . | 20–60 min. (1.0– |

**Physiologic Action.**—In therapeutic doses ammonium carbonate acts as a circulatory stimulant, a respiratory stimulant, and an expectorant. Its action is prompt, but evanescent. In large doses it is an irritant and capable of provoking emesis. It is eliminated in the urine as urea.

**Therapeutics.**—Ammonium carbonate may be substituted for the water or one of the spirits of ammonia in combatting *syncope, collapse,* and *other forms of sudden heart failure.* As a stimulant expectorant it is especially useful in *bronchitis* associated with cardiac or respiratory weakness. In *pneumonia,* both croupous and catarrhal, it often acts beneficially in facilitating expectoration and in stimulating the circulation. In *pulmonary emphysema,* when the dyspnea and cyanosis are greatly exaggerated by attacks of acute bronchial catarrh, it acts admirably in conjunction with strychnin and digitalis.

Mixed with half its bulk of stronger water of ammonia and scented, it constitutes the "smelling-salts," a popular remedy for syncope.

**Administration.**—On account of the rapidity with which ammonium carbonate is decomposed after absorption it is necessary, to secure the desired effect, to administer it at intervals of not more than two hours. It is always given in solution, the favorite vehicle being syrup of acacia.

**Incompatibles.**—It is incompatible with acids, acid salts, alkaloidal salts, and ferric salts.

## BENZOINUM, U. S. P.

(Benzoin; Gum Benzoin.)

Benzoin is a balsamic resin obtained from *Styrax Benzoin,* a large tree growing in Sumatra, Java, Borneo, and Siam. It contains several resins, benzoic acid (15–20 per cent.), a volatile oil, cinnamic acid, and vanillin. It is soluble in about 5 parts of warm alcohol and in solutions of the fixed alkalis. Benzoic acid is soluble in 2 parts of alcohol and very sparingly soluble in water. The salts of benzoic acid—ammonium, lithium, and sodium—are readily soluble in water.

| Preparations. | Dose. |
|---|---|
| Tinctura Benzoini, U. S. P. . . . . | 20–60 min. (1.2–4.0 c.c.). |
| Tinctura Benzoini Composita, U. S. P. (Friar's or Turlington's Balsam: 10 per cent., with aloes, tolu, and storax) . . . | 20–60 min. (1.2–4.0 c.c.). |
| Adeps Benzoinatus, U. S. P. (2 per cent.). | |
| Acidum Benzoicum, U. S. P. . . . . | 5–20 gr. (0.3–1.3 gm.). |
| Ammonii Benzoas, U. S. P. . . . . | 5–30 gr. (0.3–2.0 gm.). |
| Lithii Benzoas, U. S. P. . . . . | 5–30 gr. (0.3–2.0 gm.). |
| Sodii Benzoas, U. S. P. . . . . | 5–30 gr. (0.3–2.0 gm.). |

Benzoic acid (0.4 per cent.) also enters into camph
tincture of opium, or paregoric.

**Physiologic Action.**—Benzoic acid is an antisep
considerable power and a stimulant to the mucous memb
In health moderate doses do not affect the functions
body beyond increasing, to a variable degree, the nitrog
output and lessening the quantity of ethereal sulphates
indican in the urine. It escapes from the body rapidly,
through the kidneys, and for the most part in the form
puric acid—a compound of benzoic acid with the
derivative, glycocoll. It is generally believed that b
acid increases the acidity of the urine, but according to
Ashhurst, who has investigated the subject very ca
sodium benzoate, at least, has little or no influence
acidity of urine that is already acid, but that it does ren
kaline urine acid; not so much by its presence, howeve
its power of arresting ammoniacal fermentation. In
doses benzoic acid and benzoates have an irritant ac
the stomach, and in consequence excite nausea and vo

**Therapeutics.**—The compound tincture of benzoin
over the part and allowed to dry is a useful *protect*
*small wounds*. A combination of the compound tinctu
4 parts of glycerin makes an efficient application in *c*
*nipples*, *hands*, or *lips*. A dram (4.0 c.c.) to a pint (0.5
boiling water may be used as an inhalant in *acute la*
and *bronchitis*. The tincture may be prescribed int
also in *subacute* and *chronic bronchitis* when expector
very viscid. Benzoic acid itself often affords prompt
*phosphaturia*, and in *cystitis with ammoniacal urine*.
benzoate, in doses of from 5–10 gr. (0.3–0.6 gm.), is
useful remedy in *acute pharyngitis* and *tonsillitis*.

Owing to the fact that benzoic acid is eliminated
soluble hippuric acid, it was hoped that the benzoate
prove of value in gout, but experience has shown th
are of no avail. Senator and others have recommen
benzoates in rheumatism, but they have been found t
less efficacious than the salicylates.

The treatment of *phthisis* by intravenous injections
namic acid (see p. 190), so highly recommended by La
is very painful and does not seem to have given any
results than can be obtained by other means.

**Administration.**—Benzoic acid is best administ
capsules or pills. The benzoates may be administered
tion or in powders. The tinctures are incompatible wit
ous preparations.

## BALSAMUM PERUVIANUM, U. S. P.

(Balsam of Peru.)

Balsam of Peru is a brownish-black, syrupy liquid, obtained by bruising the bark of *Toluifera Pereira*, a large tree growing in Central America. It has a smoky, vanilla-like odor and a bitter, persistent taste. It is soluble in alcohol, chloroform, and glacial acetic acid. It contains resins, cinnamic and benzoic acids, and traces of vanillin. The dose is from 5–30 min. (0.3–2.0 c.c.).

**Therapeutics.**—Balsam of Peru is chiefly employed as a protectant and parasiticide. It was at one time used as a stimulant expectorant in *chronic bronchitis*, but it has been entirely replaced by more elegant remedies. It is still occasionally employed as a stimulant protectant dressing in *bed-sores* and *other ulcers*. Alone, or in combination with sulphur, it is a reliable remedy in *scabies*, in which disease it may be prescribed as follows:

℞ Sulphuris præcipitati,
Balsami Peruviani, āā ℥ij (8.0 gm.);
Olei olivæ, f℥ss (15.0 c.c.);
Adipis, q. s. ad ℥ij (60.0 gm.).—M.

## BALSAMUM TOLUTANUM, U. S. P.

(Balsam of Tolu.)

Balsam of tolu is a yellowish-brown, semiliquid mass, obtained by incising the bark of *Toluifera Balsamum*, an evergreen tree growing in South America. It has a vanilla-like odor and a mild, aromatic taste, and is soluble in alcohol, ether, and chloroform, but is insoluble in water. It contains resin, a volatile oil, vanillin, and cinnamic and benzoic acids. The dose is from 5–30 gr. (0.3–2.0 gm.).

| Preparations. | Dose. |
|---|---|
| Syrupus Tolutanus, U. S. P. | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Tinctura Tolutana, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Tinctura Benzoini Composita, U. S. P. (4 per cent.) | 20–60 min. (1.2–4.0 c.c.). |

**Therapeutics.**—Balsam of tolu has but feeble medicinal properties. It is chiefly employed on account of its agreeable flavor as a vehicle in cough-mixtures.

## AMMONIACUM.

(Ammoniac.)

Ammoniac is a gum-resin obtained by puncturing the s
of *Dorema Ammoniacum*, a plant growing in Persia and
kestan. The dose is from 10–30 gr. (0.65–2.0 gm.).

**Therapeutics.**—Ammoniac was once much used
stimulant expectorant and a counterirritant, but it has
largely superseded by more efficient remedies.

## EUCALYPTUS, U. S. P.

Eucalyptus is the leaves of *Eucalyptus Globulus*, or gum
a native of Australia, and cultivated in Europe and Sou
United States. It contains a volatile oil (6 per cent.),
which is obtained a neutral body, *eucalyptol*. The latte
colorless liquid, having a camphoraceous odor and a pur
spicy taste, and on exposure to a temperature below 3
solidifying into a mass of needle-shaped crystals. It
soluble in water, but freely so in alcohol.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Eucalypti, U. S. P. . . . | 20–60 min. (1.2–4.0 c.c.) |
| Oleum Eucalypti, U. S. P. . . . . | 3–10 (0.2–0.6 c.c.). |
| Eucalyptol, U. S. P. . . . . | 3–10 (0.2–0.6 c.c.). |

Eucalyptol also enters into the official antiseptic so
(Liquor Antisepticus).

**Physiologic Action.**—Oil of eucalyptus is a local ir
When applied to the skin, evaporation being prevented, it c
redness and even vesication. When taken internally in
doses (20 min.—1.2 c.c.), it causes a sense of burning i
throat and stomach, nausea, looseness of the bowels, and
mental exhilaration, which in turn is followed by a feeli
calm. Toxic doses depress the spinal cord, medulla
heart, and in consequence induce extreme muscular weal
a fall of temperature, a feeble pulse, shallow respiratio
finally death from asphyxia. The drug is eliminated
the emunctories, and, like turpentine, it imparts the od
violets to the urine.

Both eucalyptol and the oil have pronounced anti
properties.

**Therapeutics.**—Eucalyptus was at one time used as
stitute for quinin in malaria, but its value in this diseas

never established, and to-day it is rarely, if ever, employed. In *subacute* and *chronic bronchitis* attended with copious expectoration the oil is an exceedingly useful expectorant. As an inhalant, also, oil of eucalyptus is sometimes efficacious in diminishing profuse expectoration in *bronchiectasis* and *phthisis*. A dram (4.0 c.c.) may be added to an ounce (30.0 c.c.) of liquid petrolatum and used in an atomizer; or eucalyptol alone or in conjunction with terebene may be used in an inhalation respirator.

Eucalyptol in the form of an oily spray acts very favorably in *subacute* and *chronic rhinitis*, if used after the nares have been thoroughly cleansed with an alkaline wash. The following formula, suggested by Douglass, is an excellent one:

| | | |
|---|---|---|
| ℞ | Thymol, | gr. x (0.65 gm.); |
| | Menthol, | gr. xx (1.3 gm.); |
| | Eucalyptol, | gtt. xx (0.6 c.c.); |
| | Olei cubebæ, | gtt. xl (1.2 c.c.); |
| | Benzoinol, | f℥vj (175.0 c.c.).—M. |

Oil of eucalyptus is sometimes used as a urinary antiseptic in *cystitis* and *urethritis*.

**Administration.**—The oil and eucalyptol are the best preparations for internal use. They may be given on sugar, in capsules, or in an emulsion.

## OLEUM MYRTI.

(Oil of Myrtle; Myrtol.)

Oil of myrtle is a greenish-yellow, volatile oil, distilled from the leaves and flowers of *Myrtus communis*, the common European myrtle. It has properties almost identical with those of eucalyptol. The dose is from 3–10 min. (0.2–0.6 c.c.). It is an excellent stimulant expectorant in *bronchorrhea*, *bronchiectasis*, and *fibroid phthisis*. Eichhorst has used it with satisfaction in *pulmonary gangrene*.

## SENEGA, U. S. P.

Senega is the root of *Polygala Senega*, a perennial herb growing in woody places in North America. It contains a white, amorphous body—senegin—belonging to the saponin group of glucosids.

| Preparations. | Dose. |
|---|---|
| Fluidextractum Senegæ, U. S. P. | 5–20 min. (0.3–1.2 c.c.). |
| Syrupus Senegæ, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Syrupus Scillæ Compositus, U. S. P. (fl. ext. of squill, 8 per cent.; fl. ext. of senega, 8 per cent.; tartar emetic, 0.2 per cent.) | 10–60 min. (0.6–4.0 c.c.) |

**Physiologic Action and Therapeutics.**—Seneg local irritant and emetic. It is chiefly used, howeve stimulant expectorant in *subacute* and *chronic bronchi* copious expectoration. It is often prescribed in comb with squill.

## SANGUINARIA, U. S. P.

(Bloodroot.)

Sanguinaria is the rhizome of *Sanguinaria canad* perennial herb growing in the woods of North Amer contains an alkaloid, *sanguinarin.*

| Preparations. | Dose. |
|---|---|
| Tinctura Sanguinariæ, U. S. P. | 10–30 min. (0.6–2.0 c.c |
| Fluidextractum Sanguinariæ, U. S. P. | 1–5 min. (0.06–0.3 c.c. |

**Physiologic Action and Therapeutics.**—San is a powerful irritant. In large doses it excites nau vomiting. Toxic doses of sanguinarin cause salivation intestinal peristalsis, spinal convulsions, and, finally, and respiratory failure. Sanguinaria has been employ emetic and a stimulant expectorant, but it is now m placed by more efficient and less dangerous drugs.

## ALLIUM.

(Garlic.)

Garlic is the fresh bulb of *Allium sativum*, a plant ous to Southern Europe and cultivated in North Am active principle is a volatile oil.

| Preparation. | Dose. |
|---|---|
| Syrupus Allii | 1–4 fl. dr. (4.0–15.0 c |

**Therapeutics.**—Garlic was at one time a favorite expectorant, especially for children; it has been su however, by more agreeable remedies.

## GRINDELIA, U. S. P.

Grindelia is the leaves and flowering tops of *Grindelia robusta* and *Grindelia squarrosa*, perennial herbs growing in North America, west of the Rocky Mountains. It contains resin, a bitter principle, and a volatile oil of a terebinthinate odor.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Grindeliæ, U. S. P. . . . | 15–60 min. (1.0–4.0 c.c.). |

**Therapeutics.**—Grindelia is a very useful remedy in *bronchitis complicated with asthma*. It may be prescribed alone or in combination with other antiasthmatics, as in the following formula:

℞ Sodii iodidi, ʒj (4.0 gm.);
Fluidextracti grindeliæ, fʒss (15.0 c.c.);
Tincturæ lobeliæ,
Tincturæ belladonnæ, aa fʒij (8.0 c.c.);
Fluidextracti glycyrrhizæ, fʒiij (11.0 c.c.);
Syrupi tolutani, q. s. ad fʒiij (90.0 c.c.).—M.
Sig. A teaspoonful every three or four hours.

The fumes of burning grindelia leaves are also efficacious in allaying the cough and relieving the dyspnea of asthma. A lotion consisting of an ounce (30.0 c.c.) of the fluid extract to a pint of water (0.5 L.) has been highly recommended in *rhus poisoning* and *erysipelas*. It should be applied on cloths and allowed to evaporate.

## CREOSOTUM, U. S. P.

(Creosote.)

Creosote is a mixture of phenols, chiefly guaiacol and creosol, obtained during the distillation of wood-tar, preferably of that derived from the beech. It is a colorless or faintly yellow, oily liquid, having a penetrating, smoky odor and a burning, caustic taste. It is soluble in 150 parts of water, and in all proportions in alcohol, ether, chloroform, and oils. Much of the creosote of commerce is impure carbolic acid. Notable quantities of the latter, however, may be detected by one of the following tests: first, by the formation of a coagulum when equal quantities of the suspected liquid and collodion are mixed in a dry test-tube, and, secondly, by the absence of turbidity when one or more volumes of water are added to an intimate mixture of equal volumes of the liquid and glycerin. The dose of creosote is from 1–10 min. (0.06–0.6 c.c.), gradually increased to the limit of tolerance.

| Preparation. | Dose. |
|---|---|
| Aqua Creosoti, U. S. P. (about 1 per cent.) | 1–4 fl. dr. (4.0–15.0 c.c. |

**Physiologic Action.**—The action of creosote c
resembles that of carbolic acid, but it is much less irritar
toxic. Very large doses, however, produce all the sym
commonly observed in carbolic-acid poisoning—namely,
ing pain, nausea and vomiting, vertigo, collapse, and a
simultaneous failure of the heart and respiration. As p
out by Hare, soluble sulphates—Epsom or Glauber salt
chemical antidotes.

Like all members of the phenol group, creosote is a po
antiseptic. The drug is eliminated in large part by the k
as guaiacol sulphate and creosol sulphate of potassium
certain proportion escapes from the body through the lu

**Therapeutics.**—Creosote is employed chiefly as an e
torant, an antiseptic, and a local anesthetic.

**Expectorant.**—Creosote and its derivatives are usel
pectorants in *chronic bronchitis* and *bronchiectasis* with c
purulent sputum. So long ago as Addison's time cr
was used as a remedy for *phthisis*. This use was revi
Bouchard and Gembert in 1877, and again by Sommerb
1887. While it has been shown conclusively that th
has no specific influence on the tubercle bacilli in the
nevertheless the testimony of numerous observers is co
ing that it has a positive value in allaying cough, lesseni
pectoration, and lowering temperature. It should be g
small doses gradually increased, and at once withdrawn
stomach shows any intolerance. The best results are
phthisis attended with abundant sputum. Whether th
has any other action than that of an expectorant and in
antiseptic is not known.

**Antiseptic.**—Creosote is a valuable internal antise
*chronic gastric catarrh* with flatulence and in *simple dyspe
arrhea*. Creosote water has been recommended as a disi
lotion for *sloughing ulcers*, *uterine cancer*, etc., but for such
pose it has no advantage over a dilute solution of carbo

**Local Anesthetic.**—Inhalations of creosote are oft
ful in allaying the cough of *laryngitis*, *bronchitis*, and
Ten min. (0.6 c.c.) of creosote to 10 ounces (300.0
boiling water makes a good inhalation when the ca
acute. A mixture of equal parts of creosote and s
chloroform, employed in a respirator, often serves to
the painful paroxysms of cough in phthisis. Doses
1–2 min. (0.06–0.1 c.c.) are sometimes efficacious in th

*ing of pregnancy, peptic ulcer,* and *gastric cancer.* In *toothache* a drop or two on a pledget of cotton may be inserted in the cavity of the tooth. In the form of an ointment or lotion (10 min.–1 oz.—0.6–30.0 gm.) it has been successfully employed to allay itching in *chilblains, pruritus,* and *chronic eczema,* but its odor is objectionable.

**Administration.**—For internal use it is important to secure a preparation that is comparatively free from carbolic acid. The initial dose should be small (1–3 min.—0.06–0.2 c.c.), and the amount gradually increased to 10–15 min. (0.6–1.0 c.c.). In some cases of phthisis so much as 60 or even 100 min. (4.0–6.0 c.c.) three times daily are well borne, but such large doses are usually unnecessary. Creosote should be administered after meals, and withdrawn on the first appearance of indigestion. Small doses may be given in capsules, but large doses should be given well diluted with cod-liver oil, milk, or a weak wine. In phthisis the drug has been administered hypodermically, the injections consisting of 1 part of creosote to 2 of olive or almond oil. This method of administration, however, is painful, and has little if any advantage over that by the mouth. Intratracheal injections have also been employed, but guaiacol is preferable for this mode of administration. In diarrhea creosote may be prescribed in a powder of bismuth, as in the following formula:

℞ Creosoti, ♏xij (0.75 c.c.);
Morphinæ sulphatis, gr. j (0.065 gm.);
Bismuthi subnitratis, ℥ss (15.0 gm.).—M.
Fiant chartulæ No. xii.
Sig. One every three hours.

**Incompatibles.**—Strong nitric and sulphuric acids act violently upon creosote. It reduces silver salts and may explode when triturated with oxid of silver. It is also incompatible with ferric chlorid.

**Creosote Carbonate (Creosotal).**—This is an oily liquid containing a mixture of the carbonates of the various phenols found in creosote. Its chief ingredient is guaiacol carbonate. It is odorless, of a slightly bitter taste, insoluble in water, but freely so in alcohol, ether, and oils. It has pronounced advantages over creosote in having but little taste and in being more acceptable to the stomach. It may be employed in the same class of cases as creosote. Leyden and Cornet have highly recommended it in *pulmonary tuberculosis.* The dose is from 1–3 min. (0.06–0.2 c.c.), gradually increased to 10–20 min. (0.6–1.2 c.c.), thrice daily. It may be given in capsules or in oil, milk, claret, or beef-tea.

**Guaiacol, U. S. P.**—This phenol derivative is the constituent of creosote, from which it is obtained by fra distillation. It is a colorless, oily liquid, having a rath pleasant aromatic odor and taste. It is slightly soluble in but freely so in alcohol and ether. It readily unites wit radicles to form crystalline compounds. The dose is fro min. (0.06–0.2 c.c.), gradually increased to 20 min. (1. It should be given in the same manner as creosote.

The action of guaiacol resembles that of carbolic ac creosote. In toxic doses it causes burning in the st

The action of guaiacol resembles that of carbolic ac creasote. In toxic doses it causes burning in the st nausea and vomiting, brown-red urine, unconsciousne collapse. Wyss has reported a case of fatal poisonin girl of nine years from a dose of 80 min. (5.0 c.c.). absorbed and eliminated with great rapidity, undergoing oxidation in the body, and appearing in the urine as onates and ether sulphates. When applied to the skin ficient quantity (20–30 min.—1.2–2.0 c.c.), evaporation prevented, it causes in fever a marked fall of tempe This antipyretic effect follows immediately upon its abs is attended with copious perspiration and depression, ar comparatively short duration.

Guaiacol has been used internally as a substitute for c in *chronic bronchitis* and *pulmonary tuberculosis*, but it largely replaced by the more elegant carbonates of c and guaiacol. Intralaryngeal injections into the trach mixture of guaiacol (1–2 per cent.) and olive oil are son very useful in *allaying cough* in chronic pulmonary d From 10–20 min. (0.6–1.2 c.c.) of the mixture may be i once or twice a day. Guaiacol cannot be recommende antipyretic, since its external application in typhoic tuberculosis, and other infections is sometimes follo profound exhaustion and even by collapse. The dr proved of some value as a local anesthetic. In *epid* and *orchitis* the gentle inunction of an ointment of g and lanolin (1 : 5), followed by the application of a fitting suspensory bandage, affords much relief. In *la tuberculosis* an oily spray of guaiacol (20–40 per c sometimes useful.

**Guaiacolis Carbonas, U. S. P.**—Guaiacol carb produced by the action of carbonyl chlorid on the sodi of guaiacol. It is a white, crystalline powder, neutral tion, odorless and tasteless, insoluble in water, and slig in alcohol, glycerin, and oils. The dose is from 3–10 g 0.65 gm.), gradually increased to 30 gr. (2.0 gm.), thri

According to Hesse, guaiacol carbonate is distinc

poisonous than either guaiacol or creosote. On account of its freedom from odor and taste it is often much better borne than creosote. It is an excellant expectorant in *purulent bronchitis*, *bronchiectasis*, and *phthisis*. In doses of 10 grains (0.65 gm.), gradually increased to 20 grains (1.3 gm.), thrice daily, it has been highly recommended by Luff and others in *rheumatoid arthritis*. As it undergoes reduction in the intestine, it may be employed also as an *intestinal antiseptic*. It may be prescribed in pills, capsules, or powders.

℞ Strychninæ sulphatis, gr. ¼ (0.016 gm.);
Codeinæ sulphatis, gr. ij (0.13 gm.);
Guaiacoli carbonatis, gr. I (3.0 gm.);
Terebeni, ♏ I (3.0 c.c.).—M.
Pone in capsulas No. xxiv.
Sig. Two capsules every four hours (*subacute bronchitis*).

**Potassium Guaiacol Sulphonate (Thiocol).** — This compound occurs as a white, odorless powder, of a faintly bitter and then sweetish taste. It represents about 60 per cent. of guaiacol. Its chief advantage over the carbonate of guaiacol is its ready solubility in water. It may be given in doses of from 5–30 gr. (0.3–2.0 gm.), thrice daily, in some aromatic water.

Other preparations of guaiacol are sometimes employed, such as the benzoate (benzosol), phosphite (guaiacol-phosphal), cinnamate (styracol), and glycerol-ether (guaiamar), but they have no special advantages.

## PIX LIQUIDA, U. S. P.

(Tar.)

Tar is an empyreumatic oleoresin obtained by the destructive distillation of *Pinus palustris* and other species of *Pinus*. It is a thick, blackish liquid, having a terebinthinate odor and a pungent taste. It is only sparingly soluble in water, but freely so in alcohol, oils, and alkaline solutions. Its active constituents are guaiacols and creosols. When subjected to distillation it yields a volatile oil—*oil of tar*. The dose is from 3–15 gr. (0.2–1.0 gm.).

| Preparations. | Dose. |
|---|---|
| Oleum Picis Liquidæ, U. S. P. . . . . | 1–5 min. (0.06–0.3 c.c.). |
| Syrupus Picis Liquidæ, U. S. P. . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Unguentum Picis Liquidæ, U. S. P. (50 per cent.). | |

A water (Aqua Picis Liquidæ) is also in use. It is made by shaking together 1 part of tar and 4 parts of water frequently for twenty-four hours, decanting and filtering. The dose is from 1–4 fl. oz. (30.0–120.0 c.c.).

**Physiologic Action and Therapeutics.**—Tar is a stimulant and an antiseptic. It is chiefly employed in me as an expectorant, and as a local remedy in certain c skin diseases. In *chronic bronchitis with abundant s and hard, paroxysmal cough* it sometimes succeeds after remedies have failed. It may be given in pills or capsu in the form of the syrup or water. Murrell has found tions of tar-water also useful in the same class of cases

In *chronic eczema* and *psoriasis*, when the lesions are slu an ointment of tar makes a useful application; the offici ment is generally too strong, ½–2 dr. (2.0–8.0 gm.) to the (32.0 gm.) of lard being quite sufficient in the majo cases. It should always be employed tentatively, as in persons the skin is exceedingly sensitive to the drug absolutely contraindicated if the inflammation is at all

## OTHER STIMULANT EXPECTORANTS.

**Squill** (see p. 224).—Syrup of squill, in doses of ½ (2.0–4.0 c.c.), is an excellent expectorant in the *later st acute bronchitis*. The compound syrup of squill cont addition to squill, senega and tartar emetic, and is too d ing for ordinary use.

As syrup of squill contains free acetic acid, it is inc ble with ammonium carbonate and other alkaline carb

**Oil of Santal** (see p. 236).—When pure, this dru proves a useful expectorant in *subacute* and *chronic br* with heavy, purulent sputum. Its chief drawback is dency to disturb the stomach. It should be given in d from 5–20 min. (0.3–1.2 c.c.), in capsules or in an em Terebene and oil of eucalyptus are efficient synergists.

**Copaiba and Cubeb** (see pp. 234 and 235).—Th copaiba and the oleoresin of cubeb have been employe pectorants in *chronic bronchitis with profuse purulent* but they are neither so efficacious nor so elegant as t oil of eucalyptus, and the preparations of guaiacol. S cigarettes containing cubeb sometimes affords relief paroxysms of *asthma*. Lozenges of cubeb are usefu lieving hoarseness and fatigue of the larynx resulting fi longed use of the voice.

**Oil of Turpentine** (see p. 236).—This drug, onc used as an expectorant in *chronic bronchitis*, has been replaced by terebene and terpin hydrate. Tereben *benum*, U. S. P.) is a liquid hydrocarbon made by c oil of turpentine with strong sulphuric acid. The from 5–10 min. (0.3–0.6 c.c.). Terpin hydrate is a cr

compound obtained by the interaction of oil of turpentine, alcohol, and nitric acid. The dose is from 2–15 gr. (0.13–1.0 gm.). Terebene is one of the most satisfactory remedies we possess in *bronchitis* with free expectoration. In *phthisis*, also, it is of service when the catarrhal symptoms are prominent. In moderate doses it is usually well received, but large doses may excite nausea or irritation of the kidneys and bladder. As it is insoluble in water, it should be given in capsules, on sugar, in an emulsion, or in an elixir. It may also be inhaled, either as a spray or from the sponge of a respirator.

Terpin hydrate has therapeutic properties similar to those of terebene, but it is less active. It may be given in pills, in capsules, or in an elixir. Terpinol, an oily body derived from terpin hydrate, has been employed as an expectorant in doses of from 3–15 min. (0.2–1.0 c.c.). It is not so efficient as terebene.

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## TONICS.

Tonics are drugs that impart strength or tone to the tissues. In one sense every drug that favorably influences disease is a tonic, since, by removing the cause of debility, it serves to restore normal vitality. The term, however, is customarily restricted to remedies that have a more or less general invigorating effect, without necessarily exerting a specific influence on any one organ. A more exact knowledge of the pharmacologic action of drugs and a clearer appreciation of the primary causes of general weakness and malnutrition have tended to diminish gradually, but steadily, the number of remedies grouped under this heading. The following drugs may still be classed conveniently as tonics:

| | |
|---|---|
| Iron. | Calcium phosphate. |
| Phosphorus. | Calcium hypophosphite. |
| Cod-liver oil. | |

*Nux vomica*, *cinchona*, and *arsenic* also exert a tonic influence, but as this is subordinate to their other actions, these drugs have been considered in other groups.

### FERRUM, U. S. P.

(Iron; Fe.)

Iron is official in the form of fine, bright, non-elastic wire.

**Physiologic Action.**—As iron is a constituent of the

normal body, it may be regarded as a food as well as a me
It is especially abundant (0.4 per cent.) in hemoglobin,
presence in this compound is intimately associated w
function of the red corpuscles to carry oxygen from th
to the tissues. When iron is taken in therapeutic doses
as an astringent, causing more or less constipation.
doses have an irritant effect and disturb digestion. It
definitely known that both inorganic and organic prepa
of the metal are capable of absorption. Only a small p
however, of the quantity ingested enters the blood, the
portion being discharged from the bowel as a sulphid
albuminate, the stools, owing to the presence of the
acquiring a deep black color. Absorption takes place
in the duodenum, the iron entering the general cir
probably as an albuminate. According to Macallum
portation is effected through the agency of the leuk
and, more especially, of the blood-plasma. The amou
is absorbed varies with the nature of the preparation
quantity that is administered. From the blood the iro
posited temporarily in the spleen, liver, and bone-marr
in one of these organs, perhaps the liver, it is conver
hemoglobin. That which is absorbed in excess of the
ments of the blood is not eliminated in the secreti
escapes from the body through the intestinal epitheliur
when injected directly into a vein, the iron reappears c
the intestines, and the amount of the metal in the urin
materially increased.

In health the iron naturally contained in food is all-s
for the needs of the system, and the administration of
nal iron is not followed by any notable increase in the
of red blood-cells or their hemoglobin value. In certa
of anemia, however, especially chlorosis, chalybeate
tions increase the amount of hemoglobin and, to a les
the number of red blood-cells. Whether the drug act
by furnishing material for the corpuscles or by stimul
functional activity of the blood-making organs is no

**Untoward Effects.**—The continued use of iron, e
of the ferric salts, frequently excites indigestion, con
and headache. Discoloration of the tongue and te
occasionally follows its use, and is thought to be d
formation in the mouth of a black sulphid or tannate

**Therapeutics.**—The most important indication fo
of iron is *anemia.* The best effects are seen in *chl*
which disease the drug has almost a specific ac
*secondary anemia* the results of its use are less dec

after the removal of the cause it serves to hasten the restoration of the blood to its normal condition. Iron plays indirectly the part of an emmenagogue in *amenorrhea* dependent upon anemia. Some of its salts are used as *astringents* and *styptics*.

**Contraindications.**—The chief contraindication is gastric irritation. It is generally badly borne, probably on account of impaired digestion, in febrile diseases and in gout.

**Administration.**—Ordinarily iron should be administered by the mouth and after meals. The least astringent preparations are the carbonate, citrate, ammonioferric citrate, ammonioferric tartrate, pyrophosphate, and reduced iron. The numerous organic compounds of iron with albumin have no great advantages over many of the older inorganic salts, but they are less liable to disturb digestion, and are, probably, somewhat more readily absorbed. In exceptional cases iron may be given hypodermically. For this purpose a freely soluble preparation, such as ammonioferric citrate, should be selected, and the solution should be freshly prepared and well diluted.

**Incompatibles.**—Ferrous and ferric salts are incompatible with all preparations containing tannic or gallic acid; with ammonia, alkaline carbonates, and mucilage of acacia.

### FERRUM REDUCTUM, U. S. P.

(Reduced Iron; Iron by Hydrogen; Quevenne's Iron.)

Reduced iron is a fine, grayish-black, insoluble powder, without odor or taste. When pure it is quite free from irritating properties, and, being but feebly astringent, it has little tendency to cause constipation. It is employed only as a *hematinic*. It may be given in doses of from 1–5 gr. (0.06–0.3 gm.), in pills, capsules, or lozenges.

### FERRI CARBONAS.

(Iron Carbonate; Green Ferrous Carbonate; $FeCO_3$.)

Iron carbonate is an unstable compound which is readily converted into ferric hydrate on exposure to air. It is not official.

| Preparations. | Dose. |
|---|---|
| Ferri Carbonas Saccharatus, U. S. P. (contains 15 per cent. of freshly precipitated ferrous carbonate, protected from oxidation by sugar) . . . . . | 5–15 gr. (0.3–1.0 gm.). |
| Mistura Ferri Composita, U. S. P. (compound iron mixture; Griffith's Mixture: carbonate of iron in suspension with potassium sulphate, myrrh, and sugar) . | 1–4 fl. dr. (4.0–15.0 c.c.). |

| Preparation. | Dose. |
|---|---|
| Massa Ferri Carbonatis, U. S. P. (Vallet's Mass: about 42 per cent. of ferrous carbonate with sugar and honey) . . . . . | 3–5 gr. (0.2–0.3 gm.). |
| Pilulæ Ferri Carbonatis, U. S. P. (Blaud's Pills: each pill contains about 1 gr.—0.06 gm.—of ferrous carbonate, made with crystallized ferrous sulphate and potassium carbonate) . . . . . | 1–3 pills. |

**Therapeutics.**—These preparations are comparativel from astringency, and are convenient forms in which to a ister iron. They are used solely in *anemia*. The sacch carbonate and the pills of the carbonate (Blaud's pills) a favorite preparations. The former should be given a pills or else in capsules. Griffith's mixture is superf Some practitioners prefer Blaud's pills made according original formula (equal parts of potassium carbonate and ferrous sulphate) to those made according to the formula. The former contain a certain amount of free sium carbonate.

### FERRI CHLORIDUM, U. S. P.

(Ferric Chlorid; Sesquichlorid or Perchlorid of Iron; $Fe_2Cl_6 + 12$

Ferric chlorid occurs in deliquescent, orange-yellow c line pieces, having an astringent, chalybeate taste. It used internally, but sometimes externally as an astringe styptic.

| Preparations. | Dose. |
|---|---|
| Liquor Ferri Chloridi, U. S. P. (contains about 29 per cent. of the crystallized salt) . . . . . | 3–10 min. (0.2–0.6 c.c.) |
| Tinctura Ferri Chloridi, U. S. P. (contains about 13 per cent. of anhydrous ferric chlorid, with alcohol, water, and a trace of nitrous ether) . . . . . | 5–30 min. (0.3–2.0 c.c.) |
| Liquor Ferri et Ammonii Acetatis, U. S. P. (Basham's Mixture: Tincture of ferric chlorid, 4 parts; dilute acetic acid, 6 parts; solution of ammonium acetate, 50 parts; aromatic elixir, 12 parts; glycerin, 12 parts; water, to make 100 parts) . . | 1–4 fl. dr. (4.0–15.0 c.c |

**Therapeutics.**—The solution of ferric chlorid i used locally as a styptic in controlling bleeding after *traction of teeth, removal of tonsils*, or *application of* In *postpartum hemorrhage* it should not be used exc last resort. It may occasionally be of service in *hem* and *entrorrhagia*, on account of its local action, but it possibly do good in other internal hemorrhages.

External pedunculated piles have been successfully treated by injecting them, after they have been clamped, with a few minims of the tincture. The treatment of aneurysm by injections of ferric chlorid, as first advised by Pravaz, is dangerous, and fortunately obsolete. The tincture, in the strength of ½–1 fl. dr. (2.0–4.0 c.c.) to the ounce (30.0 c.c.) of water, may be used as an astringent application in *chronic pharyngitis* and *laryngitis*. Ferric chlorid in the form of the tincture or the solution is a valuable local remedy in *pharyngeal diphtheria*. It may be prescribed as follows:

℞ Tincturæ ferri chloridi, f℥j–iij (4.0–11.0 c.c.);
Glycerini, f℥ss (15.0 c.c.);
Aquæ, q. s. ad f℥j (30.0 c.c.).—M.

Or as Löffler's solution:

℞ Menthol, ʒiiss (10.0 gm.);
Toluol, f℥x (36.0 c.c.);
Alcoholis absoluti, f℥ij (60.0 c.c.);
Liquoris ferri chloridi, f℥j (4.0 c.c.).—M.

The tincture is an efficient hematinic in *anemia*, but it is more liable than many of the other preparations of iron to injure the teeth, disturb digestion, and induce constipation. Basham's mixture is a favorite chalybeate diuretic in *chronic nephritis;* only small doses, however, should be given, and even these should be withheld if the drug causes constipation and headache. The tincture has long been regarded as a specific in *erysipelas*. This claim cannot be substantiated, although the drug is of benefit in some cases. It may be given in doses of from 15–20 min. (1.0–1.2 c.c.) every two or three hours.

**Administration.**—The tincture of ferric chlorid should be taken after meals, well diluted, through a tube.

**Ferrum Dialysatum** (*Dialyzed Iron*).—This is an unofficial preparation of the oxychlorid of iron from which acidulous matter has been removed by dialysis. It is a dark-red, tasteless, neutral liquid, quite free from astringency. It is a very unstable compound, and undergoes rapid decomposition in the stomach. It is an extremely feeble chalybeate, but a useful antidote in *arsenical poisoning*.

The dose as a hematinic is from 10–30 min. (0.6–2.0 c.c.); as an antidote, ½ fl. oz. (15.0 c.c.) frequently repeated.

### FERRI HYDROXIDUM, U. S. P., AND FERRI HYDROXIDUM CUM MAGNESII OXIDO, U. S. P.

(Ferric Hydroxid; $Fe(OH)_3$ and Ferric Hydroxid with Magnesia.)

These preparations are used exclusively as antidotes in *arsenical poisoning*. The former may be precipitated from any

liquid preparation of iron by adding to it an alkali (am
or sodium carbonate); the latter, by adding magnesia in e
If a caustic alkali has been employed, such as ammon
excess should be removed by transferring the precipitat
muslin filter, squeezing it and washing it with fresh
Ferric hydroxid with magnesia is preferable, since it nee
washing, and since the magnesia itself is antidotal.
preparations should be freshly made and given freely, whi
moist, in doses of a tablespoonful or more every few m

### FERRI SULPHAS, U. S. P.

(Ferrous Sulphate; Green Vitriol; $FeSO_4 + 7H_2O$.)

Ferrous sulphate occurs as pale, bluish-green, efflor
prisms, having a saline, styptic taste. The dose is fro
gr. (0.06–0.3 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Ferri Sulphas Exsiccatus, U. S. P. . . . . | 1–3 gr. (0.06–0.2 gm.). |
| Ferri Sulphas Granulatus, U. S. P. . . . . | 1–5 gr. (0.06–0.3 gm.). |
| Mistura Ferri Composita (Griffith's Mixture) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c. |
| Pilulæ Aloes et Ferri (contain about 1 gr. —0.06 gm.—of each) . . . . . | 1–3 pills. |
| Pilulæ Ferri Carbonatis (Blaud's Pills) . . | 1–3 pills. |

**Therapeutics.**—Sulphate of iron is an active astr
It may be employed as a hematinic in *anemia* attended
laxation of the bowels. The dried sulphate should be s
for pills.

Crude ferrous sulphate, or copperas, is used as a di
ant and deodorizer for privies, cess-pools, etc., but its
cidal power is very feeble.

### FERRI SUBSULPHAS.

(Ferric Subsulphate; Basic Ferric Sulphate; Monsel's Salt; $Fe_4O($S

Ferric subsulphate is a yellow, hygroscopic, ast
powder, freely soluble in water.

| PREPARATION. | DOSE. |
|---|---|
| Liquor Ferri Subsulphatis, U. S. P. (Monsel's Solution) . . . . . | 3–5 min. (0.2–0.3 c.c.). |

**Therapeutics.**—Monsel's solution is a prompt and
ful styptic, which is somewhat less irritant in its actic
the solution of ferric chlorid. It is employed chiefl
*local hemostatic*. When used too freely it produces har
clots, which may serve to conceal deep-seated hemc
For this reason it should not be poured into the wou

applied directly to the bleeding surface on a pledget of cotton. In *hematemesis* a few drops in water may prove efficient. It has been recommended in the form of a spray in *hemoptysis*, but it is of doubtful utility.

### FERRI ET AMMONII SULPHAS, U. S. P.

(Ferric Ammonium Sulphate; Ammonioferric Alum.)

Ammonioferric alum occurs as pale-violet, efflorescent crystals, odorless, and of a sour, styptic taste. It is a more powerful astringent than ordinary alum (aluminum and potassium sulphate). It has been employed in saturated solution as a hemostatic in *capillary bleeding*, and in weak solutions as an astringent injection in *leukorrhea*.

### FERRI IODIDUM.

(Ferrous Iodid; Protiodid of Iron; $FeI_2$.)

Ferrous iodid occurs in grayish-white, crystalline masses which are soluble in water with partial decomposition. It is rarely used in the pure form.

| PREPARATIONS. | DOSE. |
|---|---|
| Syrupus Ferri Iodidi, U. S. P. (contains 5 per cent. by weight of ferrous iodid) . . | 5–60 min. (0.3–4.0 c.c.). |
| Pilulæ Ferri Iodidi, U. S. P. (contain about 1 gr.—0.06 gm.—of ferrous iodid) . . . . . | 1–3 pills. |

**Therapeutics.**—Iodid of iron may be employed when it is desirable to combine an alterative with a chalybeate. It is a very useful preparation in *tuberculous adenitis*, *syphilitic cachexia*, and *rachitis*. It is usually well tolerated by children, to whom the syrup may be given in doses of from 3–20 min. (0.2–1.2 c.c.), thrice daily, after meals. J. C. Wilson has found large doses of the syrup efficacious in *articular rheumatism* and *other forms of acute arthritis* after failure with salicylic compounds.

As the syrup is injurious to the teeth, it should be taken well diluted, and the mouth should be thoroughly rinsed after its administration.

### FERRI CITRAS, FERRI PHOSPHAS, AND FERRI TARTRAS.

These compounds are known as the scale preparations, because concentrated solutions of them are spread on plates of glass and allowed to evaporate, so that the salts may be obtained in the form of scales. The following are official:

| Preparations. | Dose. |
|---|---|
| Ferri Citras, U. S. P. | 2–5 gr. (0.13–0.3 gm.). |
| Ferri et Ammonii Citras, U. S. P. (contains 16 per cent. of metallic iron) | 5–10 gr. (0.3–0.6 gm.). |
| Ferri et Quininæ Citras, U. S. P. (contains 11.5 per cent. of quinin and 13.5 per cent. of metallic iron) | 5–10 gr. (0.3–0.6 gm.). |
| Ferri et Quininæ Citratis Solubilis, U. S. P. (same strength as preceding preparation, but more soluble) | 5–10 gr. (0.3–0.6 gm.). |
| Ferri et Strychninæ Citras, U. S. P. (contains 1 per cent. of strychnin and 16 per cent. of metallic iron) | 1–5 gr. (0.065–0.3 gm.). |
| Ferri et Ammonii Tartras, U. S. P. (contains 13 per cent. of metallic iron) | 5–10 gr. (0.3–0.6 gm.). |
| Ferri et Potassii Tartras, U. S. P. (contains 15 per cent. of metallic iron) | 5–10 gr. (0.3–0.6 gm.). |
| Ferri Phosphas Solubilis, U. S. P. (the solubility of this salt is dependent upon the presence of free sodium citrate) | 3–10 gr. (0.2–0.6 gm.). |
| Ferri Pyrophosphas Solubilis, U. S. P. (the solubility of this salt is dependent upon the presence of free sodium citrate) | 3–10 gr. (0.2–0.6 gm.). |

From iron and quinin citrate, bitter wine of iron (*V*
*Ferri Amarum*, U. S. P.) is prepared, and from iron and am
nium acetate wine of iron (*Vinum Ferri*, U. S. P.) is prep
The dose of either wine is from 1–3 fl. dr. (4.0–11.0 c.c.).
phosphate enters into the glycerite of the phosphates of
quinin, and strychnin (*Glyceritum Ferri, Quininæ et Strych*
*Phosphatum*), the dose of which is 10–30 min. (0.6–2.0
and the syrup of the phosphates of iron, quinin, and stry
(*Syrupus Ferri, Quininæ et Strychninæ Phosphatum*, U. S
the dose of which is from 1–2 fl. dr. (4.0–8.0 c.c.).

**Therapeutics.**—The scale preparations of iron are
and agreeable *hematinics*. They are comparatively free
astringency, and are usually well borne by the stomach.
account of their solubility they are well adapted for admin
tion in liquid form.

### FERRUM ALBUMINATUM.

Bunge first demonstrated that iron exists in the tissue
in various food-stuffs in the form of a nucleo-albuminate.
subsequently succeeded in separating such a compound
the yolk of eggs, and this he called *hematogen*. The
differs from ordinary iron salts in being very resistant t
action of sulphids. According to Bunge, inorganic pre
tions of iron are not absorbed to any extent by the he

mucous membrane of the alimentary canal, and are useful in anemia only by disposing of the sulphureted hydrogen in the intestine, and thus protecting the food-iron from reduction until its absorption has been accomplished. Recent investigations have proved conclusively that Bunge's view is fallacious, and that inorganic iron compounds are quite capable of absorption and assimilation. Albuminates and peptonates of iron, however, are often better borne by the stomach than the inorganic salts, are less injurious to the teeth, and are, perhaps, somewhat more readily absorbed. Many attempts have been made to produce artificially, and in a way that can be practically utilized, compounds having the characteristics of Bunge's hematogen. Schmiedeberg obtained from pig's liver a compound containing from 6–8 per cent. of iron, which he called *ferratin*. Later this preparation was obtained in larger quantities by the action of iron salts on egg-albumen. It is a fine, reddish powder, without odor or taste, insoluble in water, but soluble in dilute alkalis. The dose is from 3–10 gr. (0.2–0.6 gm.). It may be given in capsules, powders, or tablets, or with milk. Kobert has obtained two compounds—*hemogallol* and *hemol*—from ox-blood by reducing the hemoglobin with pyrogallol and zinc dust respectively. The dose of either compound is from 2–8 gr. (0.13–0.5 gm.).

**Ferri Lactas** (*Ferrous Lactate*).—This preparation occurs in pale, greenish-white, crystalline crusts, having a slight characteristic odor and a sweetish, ferruginous taste. It is slowly soluble in water. It may be given in doses of from 1–5 gr. (0.06–0.3 gm.).

**Ferri Oxalas** (*Ferrous Oxalate*).—This salt occurs as a pale-yellow, odorless, crystalline powder, insoluble in water. It has been lauded by Quincke and by Hayem as a hematinic in *chlorosis*, but it does not seem to have any special advantages. The dose is from 3–5 gr. (0.2–0.3 gm.).

**Ferri Hypophosphis, U. S. P.** (*Ferric Hypophosphite*).—This salt occurs as a white, odorless, and almost tasteless powder, slightly soluble in water. It has no special advantages. The dose is from 5–10 gr. (0.3–0.6 gm.). It is contained in the compound syrup of hypophosphites (*Syrupus Hypophosphitum Compositus*, U. S. P.), the dose of which is from 1–4 fl. dr. (4.0–15.0 c.c.).

**Ferri Valeras** (*Ferric Valerate*).—This compound is a dark-red, amorphous powder, having the odor of valerian and a mild styptic taste. It may be given with other valerates when a combined chalybeate and anti-spasmodic action is desired. The dose is from 1–3 gr. (0.06–0.2 gm.).

## PHOSPHORUS, U. S. P.

Phosphorus is a yellowish, semitransparent, non-me element obtained from bones. It has a waxy consistenc luster, a peculiar, garlicky odor, and a disagreeable taste. long keeping it turns red, and occasionally black. O posure it emits white fumes, which are luminous in the and on longer exposure it takes fire spontaneously. It most insoluble in water, soluble in 350 parts of ab alcohol and in 50 parts of fatty oils, and readily solu chloroform. The dose is from $\frac{1}{100}$–$\frac{1}{80}$ gr. (0.00064–0.002

| Preparation. | Dose. |
|---|---|
| Pilulæ Phosphori, U. S. P. (each pill contains $\frac{1}{100}$ gr.—0.0006 gm.) . . . . . | 1–3 pills. |

**Physiologic Action.**—Wegner found that when phorus was given in small doses to growing animals it re the bones more dense, diminished the cancellous stru and finally caused more or less obliteration of the m cavity. That these changes were due to the stimulation bone-forming tissues, and not to the deposition of an of phosphates, was shown by the fact that in animals fe phosphorus but deprived of phosphates the same hype in the bones resulted, but that the new tissue was s gelatinous instead of hard. Apart from these changes osseous system, and perhaps a slight increase in the n of red blood-cells, the effects of phosphorus in me doses are not very obvious. There is considerable testimony, however, to show that the drug improves th tion of other tissues, especially of the nervous system.

The manner in which phosphorus is absorbed has matter of some dispute; it probably enters the blood as phosphorus, absorption being facilitated by the solu the drug in the fatty substances present in the bowel. part is volatilized in the alimentary canal, and probabl the tissue in the form of vapor. Phosphorus is eli in minute quantities as phosphorus by the lungs an by the kidneys as proteid compounds, and, prob phosphates.

**Toxicology.**—Toxic doses of phosphorus do not produce their effects for several hours. The earliest sy are intense abdominal pain, obstinate vomiting, thirs licky taste in the mouth, restlessness, and prostratio ejected material contains mucus, bile, and occasionally grated blood, and is luminous in the dark. At the from twenty-four to thirty-six hours the symptoms g

subside and the patient feels comparatively comfortable, but soon the vomiting and pain return, jaundice develops, the liver becomes enlarged and painful, the pulse grows very feeble, and not infrequently ecchymoses appear in the skin and hemorrhages occur from the mucous membranes. The urine is scanty and contains albumin, tube-casts, bile, sarcolactic acid, an increased amount of ammonia, and sometimes leucin, tyrosin, and sugar. In fatal cases death occurs generally in from a few days to two weeks, and is often preceded by delirium, convulsions, stupor, and coma. Occasionally, phosphorus kills within a few hours, probably through its direct depressant influence on the heart. If the patient recovers, the symptoms abate very slowly and the convalescence is tedious.

The changes in the organs observed after death are attributable to grave disturbances of tissue-metabolism and not to the direct irritant action of the drug. The most characteristic feature is wide-spread fatty degeneration of the tissues. The latter is especially marked in the glands of the stomach and intestines, in the liver, kidneys, heart, and muscles. Ecchymoses are found in most of the organs. Areas of complete necrosis are often observed in the stomach and liver. In subacute poisoning the degenerated parenchyma may be replaced in part by newly formed connective tissue. Whether the fat found in the cells of the various organs is formed *in situ* or is carried to them from the subcutaneous tissues is a moot question.

**Treatment.**—If the phosphorus has been recently taken, the stomach should be washed out at once. Copper sulphate is probably the best emetic, since any excess may serve as an antidote by forming with the phosphorus insoluble phosphid of copper. A cathartic should be given to remove from the bowel any of the poison that may still be unabsorbed. All oily and fatty matters should be withheld, since they are active solvents of phosphorus. Various oxidizing agents have been employed as chemical antidotes. Potassium permanganate ($\frac{1}{2}$ per cent. aqueous solution) and the solution of peroxid of hydrogen are the most useful. Old French oil of turpentine, which is rich in ozone, has been repeatedly recommended, but it cannot be obtained in this country, and ordinary turpentine is useless.

**Chronic Phosphorus-poisoning.**—Workmen employed in match factories and who are exposed to the fumes of phosphorus develop a symptom-complex to which Magitot has applied the name *phosphorism.* This condition is characterized by anemia, loss of flesh, a garlicky odor of the

breath, chronic diarrhea, albuminuria, fragility of the b
and, in many instances, by necrosis of the maxillary
Since phosphorus necrosis occurs only in workmen who
carious teeth, it is usually attributed solely to the loc
tion of the fumes, but there are good reasons for bel
that systemic infection contributes largely to its develop
Thus it rarely appears, despite the existence of carious
until the worker has been some time, generally many ye
his trade; the sufferer nearly always manifests some
symptoms of systemic saturation, and finally, Stubenrau
demonstrated experimentally, that phosphorous fumes
no especial action on exposed bone or periosteum.

Red or amorphous phosphorus being insoluble in or
liquids and non-volatile is free from toxic properties.
phoric acid has none of the qualities of phosphorus, ar
merely as a mild stomachic. Sodium phosphate is an
able laxative. The hypophosphites of calcium, sodiu
potassium are innoxious, and are employed as tonics. S
phosphite is extremely poisonous. Sodium pyrophosph
sodium metaphosphate, when administered hypoderm
paralyze the central nervous system and the heart,
slow poisoning produce fatty degeneration of the gl
organs and numerous hemorrhagic extravasations.

**Therapeutics.**—Phosphorus is employed as a tonic
tain diseases of the nervous system that are dependen
exhaustion rather than upon organic changes. Thu
sometimes of service in *neurasthenia*, *neuralgia*, and *im*
from sexual excesses. It has been employed in
according to Monti, since 1838, but its reputation
disease is due largely to the very favorable reports
sowitz, in Europe, and of Jacobi, in this country. It
unlikely that much of the benefit which has been obse
rachitic subjects while taking phosphorus has been
reality to the cod-liver oil, simultaneously administered
the improvement in the diet and general hygiene. Th
receives some support from the recent investigations of
who found that phosphorus in cod-liver oil was soo
verted, through oxidation, into phosphoric acid, and, th
lost its peculiar properties. Monti contends that pho
alone has not staid the progress of rachitis nor has it
the slightest improvement.

Phosphorus has also been employed with asserte
results in other diseases of bones, such as *osteomalacia*
and *delayed union of fractures*.

**Administration.**—As phosphorus undergoes oxid

keeping in nearly all menstrua, only freshly made preparations should be prescribed. It may be administered conveniently in the form of an elixir.

℞ Phosphori . . . . . gr. ss (0.032 gm.);
Alcoholis absoluti . . . . . f℥iij (11.0 c.c.);
Olei anisi . . . . . ♏iij (0.18 c.c.);
Glycerini . . . . . f℥iss (45.0 c.c.);
Elixiris aromatici . . . . . q. s. ad f℥iij (90.0 c.c.).—M.
Sig. Thirty min. (1.8 c.c.) equal about $\frac{1}{100}$ gr. (0.0006 gm.) of phosphorus.

Persons vary considerably in their susceptibility to phosphorus, and, therefore, the initial doses should be small, especially in children. Nebelthau has cited an instance in which death occurred in a well-developed child of two years after taking less than $\frac{1}{200}$ gr. (0.003 gm.) in the course of sixty hours. Even minute doses sometimes disturb the stomach and excite unpleasant eructations.

**Zinci Phosphidum** (*Zinc Phosphid*).—This compound appears as a dark-gray, gritty powder, or as crystalline, metallic fragments having a faint odor and taste of phosphorus. It is insoluble in alcohol or water. The dose is from $\frac{1}{30}$–$\frac{1}{10}$ gr. (0.002–0.006 gm.), in pill. Its action closely resembles that of phosphorus, and it may be used for the same purposes as the latter.

**Acidum Phosphoricum, U. S. P.** (*Phosphoric Acid*).—This is a colorless liquid, composed of 85 per cent. by weight of absolute orthophosphoric acid and 15 per cent. of water. It has a strongly acid taste. The dose is from 3–5 min. (0.2–0.3 c.c.), well diluted. Its action is somewhat like that of the dilute mineral acids, and bears no resemblance to that of phosphorus. It may be employed to allay *thirst in diabetes* and *febrile diseases*. It has also been used to *promote gastric digestion*, but for this purpose it is inferior to hydrochloric acid. It is usually prescribed as diluted phosphoric acid (*Acidum Phosphoricum Dilutum*, U. S. P.), the dose of which is from 10–60 min. (0.6–4.0 c.c.), in water.

## CALCII PHOSPHAS.

(Calcium Orthophosphate; $Ca_3(PO_4)_2$.)

Calcium phosphate is official as *Calcii Phosphas Præcipitatus*, a white, odorless, tasteless, amorphous powder, almost insoluble in water. The dose is from 5–30 gr. (0.3–2.0 gm.).

| Preparation. | Dose. |
|---|---|
| Syrupus Calcii Lactophosphatis, U. S. P. (contains about 3 per cent. of the double soluble salt) | 1–4 fl. dr. (4.0–15.0 c.c.). |

**Physiologic Action and Therapeutics.**—The inso
salts of calcium, of which the phosphate may be taker
type, have no very pronounced effects upon the system.
taken internally, the greater part resists absorption and
pears in the stools; a small portion, however, enters th
culation, and in case of any deficiency in the lime-salts
food is appropriated by the tissues. In the absence
deficiency in the natural supply, any excess of lime, if i
not fail altogether of absorption, is slowly excreted b
intestinal epithelium and kidneys. As food ordinarily co
more lime than the body requires, it is difficult to unde
how the phosphate or hypophosphite of calcium can
service when administered as a remedy. The difficulty
ever, is no greater than that which is encountered in at
ing to explain the undoubted efficacy of iron in chlor
disease that is certainly not dependent upon a want o
salts in the food.

Calcium phosphate has been recommended, on th
grounds, in *rachitis* and *osteomalacia*, but it is of very
ful value. The testimony to its favorable influence on
nutrition in such diseases as *tuberculosis*, *tertiary syphi*
*neurasthenia* is more convincing, but even here it
unlikely that much of the good attributed to the phosp
in reality due to the remedies usually associated with it

**Administration.**—Calcium phosphate may be pre
in powders or capsules. The lactophosphate, being
may be given in the form of the official syrup or in a
sion of cod-liver oil.

**Calcii Glycerophosphas.**—The fact that phos
exists in the nervous system in the form of glycerophc
acid has led to the introduction of the salts of this
substitutes for phosphates and hypophosphites. The
been used chiefly in *exhaustion from overwork*, in *ta*
*valescence from the specific fevers*, in *neurasthenia*, *phosp*
and *exophthalmic goiter*. The dose of calcium glyceroph
is from 2–5 gr. (0.1–0.3 gm.), in solution or gelati
pills. Sodium glycerophosphate is employed in th
dose, and may be given by the mouth or hypodermica

## CALCII HYPOPHOSPHIS, U. S. P.

(Calcium Hypophosphite; $Ca(PH_2O_2)_2$.)

Calcium hypophosphite occurs in colorless, tra
crystals, or small, lustrous scales, of a nauseous, bitt
It is soluble in about 7 parts of water. The dose is fr
gr. (0.3–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Syrupus Hypophosphitum, U. S. P. (calcium hypophosphite, 4.5 per cent.; sodium hypophosphite, 1.5 per cent.; potassium hypophosphite, 1.5 per cent.; dilute hypophosphorous acid, 0.2 per cent.; spirit of lemon, sugar, and water) | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Syrupus Hypophosphitum Compositus, U. S. P. (calcium hypophosphite, 3.5 per cent.; potassium hypophosphite, 1.7 per cent.; sodium hypophosphite, 1.7 per cent.; ferric hypophosphite, 0.2 per cent.; manganese hypophosphite, 0.2 per cent.; quinin, 0.1 per cent.; strychnin, 0.01 per cent.; sodium citrate, 0.37 per cent.; dilute hypophosphorous acid, 1.5 per cent.; sugar and water) . . . . . | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Emulsum Olei Morrhuæ cum Hypophosphitibus, U. S. P. . . . . | 1–8 fl. dr. (4.0–30.0 c.c.). |

**Therapeutics.**—Hypophosphites may be employed in the same class of cases as that in which calcium phosphate has been recommended.

## OLEUM MORRHUÆ, U. S. P.

(Cod-liver Oil.)

Cod-liver oil is a fixed oil obtained from the livers of *Gadus morrhua* and other species of *Gadus*. The *shore oil*, or *white oil*, the only variety at present used for medicinal purposes, is extracted by disintegrating the fresh livers with superheated steam, and subsequently straining the resultant pultaceous mass. It is a pale yellow, thin liquid, having a peculiar fishy odor and taste. In addition to olein, palmitin, stearin, and other fatty principles it contains traces of iodin, bromin, phosphorus, cholesterin, trimethylamin, and, possibly, of bile-salts. The dose is from 1–4 fl. dr. (4.0–15.0 c.c.).

| PREPARATIONS. | DOSE. |
|---|---|
| Emulsum Olei Morrhuæ, U. S. P. (50 per cent.) . . . . . | 1–8 fl. dr. (4.0–30.0 c.c.). |
| Emulsum Olei Morrhuæ cum Hypophosphitibus, U. S. P. (cod-liver oil, 50 per cent.; calcium hypophosphite, 1 per cent.; potassium hypophosphite, 0.5 per cent.; sodium hypophosphite, 0.5 per cent.; oil of gaultheria, syrup, and water) | 1–8 fl. dr. (4.0–30.0 c.c.). |

**Physiologic Action and Therapeutics.**—Cod-liver oil is a food rather than a medicine. It is superior to other fats, because it is more digestible and assimilable. The amount of iodin and of phosphorus present is too small for these ingredients to exert any specific action. Attempts to isolate an active

principle have not been attended with success. The absorption of cod-liver oil has been attributed by authorities to the presence of biliary salts; by others, t presence of free fatty acids, but no explanation that ha been offered is perfectly satisfactory. In moderate doses liver oil improves the general nutrition, increases the nu of red blood-cells, and favors the accumulation of fat i body. Large doses excite nausea, eructations, vomiting diarrhea.

Cod-liver oil, provided it is well borne by the stomach be employed in any disease in which malnutrition is a p nent feature; thus it is often of great service in *tuber of the lungs, bones, or lymph-glands*, in *rickets, tertiary sy chronic rheumatism, rheumatoid arthritis, chronic bronchit valescence from the specific fevers*, and *secondary anemi* the early stage of phthisis it does more good than any medicinal agent, but it must be given cautiously and drawn upon the first evidence of intolerance. When sym of secondary infection are prominent, such as fever, sw and rapid wasting, it is less likely to be well borne or good. In conjunction with general hygienic measur prolonged use of cod-liver oil is also valuable in prev the development of tuberculosis in those who, throug sique and heredity, have a marked predisposition to the

**Contraindications.**—High fever and gastric or int irritation are the chief contraindications to its use.

**Administration.**—Patients who at first have diffic taking cod-liver oil may ultimately acquire a toleranc if the dose be carefully adapted to their digestive pow is well, therefore, to begin with very small doses, ever minims, and to increase the amount gradually as the s becomes accustomed to it. A single dose at bedtime well borne when the stomach will not tolerate it duri day. As the oil is digested in the intestine, and not stomach, its stay in the latter should be reduced to a mi and this can be accomplished by administering it two o hours after meals. Although it is impossible to disguis pletely the fishy odor and taste of cod-liver oil, there ar ways in which the unpleasantness of its administration lessened. It may be floated on the surface of wh porter, care being taken to prevent it from touching th and swallowed quickly; it may be taken in ketchu tincture of orange peel, but perhaps the best way to p it is in soft capsules holding from 10–60 min. (0.6–4 or in a well-made emulsion. Emulsions containing

cent. of oil may be made with yolk of egg, acacia, or malt extract, and flavored with oil of bitter almond, gaultheria, or cinnamon.

℞ Olei morrhuæ, ℥iv (118.0 c.c.);
Olei amygdalæ amaræ, ♏ x (0.6 c.c.);
Acaciæ, q. s.
Syrupi calcii lactophosphatis, ℥ij (60.0 c.c.);
Aquæ, q. s. ad ℥viij (235.0 c.c.).—M.
Sig. A tablespoonful twice daily, two hours after meals.

The official emulsions are made with acacia and are flavored with oil of gaultheria.

As a rule, children take cod-liver oil readily, and even grow to like it; but if it cannot be taken by the mouth, owing to gastric irritability, it may be given by inunction. Just before retiring, and after a warm bath, 1 or 2 drams (4.0–8.0 c.c.) of the oil should be rubbed into the skin over the chest and abdomen, and the child put to bed in a flannel night-dress.

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# ALTERATIVES.

Alteratives are agents that favorably modify general morbid processes without exerting a demonstrable influence on any particular organ. It need scarcely be said that the manner of their action is quite unknown; if it were known, these remedies could be better apportioned among other classes. The term alterative is simply applied for convenience to a group of heterogeneous drugs that experience has shown to be more or less efficacious in certain constitutional diseases, the real nature of which is very imperfectly understood. The most important members of this group are:

- Arsenic.
- Iodids.
- Iodin.
- Iodoform.
- Mercury.
- Ichthyol.
- Gold and sodium chlorid.
- Colchicum.
- Guaiac.
- Sarsaparilla.
- Jambul.
- Mezereum.
- Calx sulphurata.
- Uranium nitrate.
- Gland extracts (thyroid, thymus, and testicular extracts).

## ARSENUM.

(Arsenic; As.)

Arsenic is not employed for medicinal purposes in the metallic form, but as arsenic trioxid, as a salt of arsenous acid (an arsenite), or as a salt of arsenic acid (an arsenate).

| PREPARATIONS. | DOSE. |
|---|---|
| Arseni Trioxidum, U. S. P. | $\frac{1}{60}$–$\frac{1}{20}$ gr. (0.001–0.003 g |
| Liquor Acidi Arsenosi, U. S. P. (contains 1 per cent. of arsenic trioxid and 5 per cent. of diluted hydrochloric acid) | 1–5 min. (0.06–0.3 c.c.). |
| Liquor Potassii Arsenitis, U. S. P. (Fowler's Solution: contains the equivalent of 1 per cent. of arsenic trioxid and 3 per cent. of compound tincture of lavender), | 1–5 min. (0.06–0.3 c.c.). |
| Sodii Arsenas, U. S. P. | $\frac{1}{15}$–$\frac{1}{8}$ (0.004–0.008 gm.). |
| Sodii Arsenas Exsiccatus, U. S. P. | $\frac{1}{30}$–$\frac{1}{12}$ gr. (0.002–0.005 g |
| Liquor Sodii Arsenatis, U. S. P. (Pearson's Solution; contains 1 per cent. of exsiccated sodium arsenate) | 1–5 min. (0.06–0.3 c.c.). |
| Arseni Iodidum, U. S. P. | $\frac{1}{80}$–$\frac{1}{10}$ gr. (0.002–0.006 |
| Liquor Arseni et Hydrargyri Iodidi, U. S. P. (Donovan's Solution: contains 1 per cent. each of arsenous iodid and mercuric iodid) | 1–5 min. (0.06–0.3 c.c.) |

### ARSENI TRIOXIDUM, U. S. P.

(Arsenic Trioxid; Arsenous Acid; White Arsenic; $As_2O_3$.)

Arsenic trioxid occurs either as an opaque, white, amo powder, or as heavy, amorphous masses of a trans glass-like appearance. It has neither odor nor taste. thrown on hot coals it volatilizes without melting, and strong, garlicky odor. In the presence of water it b arsenous acid ($H_3AsO_3$). It is soluble in from 30–80 p cold water, slightly soluble in alcohol, and soluble i 5 parts of glycerin. The dose is from $\frac{1}{60}$–$\frac{1}{20}$ gr. (0.00 gm.).

**Physiologic Action.**—Local Action.—On mucou branes and denuded surfaces arsenic trioxid, in conce form, acts as a powerful and painful caustic. If it is over large surfaces a sufficient quantity may be abso produce systemic poisoning.

**Circulation.**—In therapeutic doses, beyond inc slightly the pulse-rate, arsenic exerts but little influ the circulation. Toxic doses, however, lessen the fr of the pulse and lower the blood-pressure. The blood-pressure appears to be due to depression of t and of the vasomotor nerves, especially of those branc tributed to the blood-vessels of the abdominal organs.

**Blood.**—In health arsenic has little or no action blood, but in certain forms of anemia, especially pe anemia, it often increases decidedly the number of eryth The view that the blood improvement is due to stimul the bone-marrow receives some support from the expe researches of Stockman and Grieg, who found that ar

creased the vascularity of the marrow and led to a replacement of fat by red corpuscles. In some cases of poisoning there is marked disintegration of the red blood-cells.

**Nervous System.**—Clinical experience indicates that in medicinal doses arsenic exerts a stimulant influence upon the nervous system. In frogs toxic doses cause a rapid paralysis, which appears to be mainly of centric origin. In man nervous phenomena occur in both acute and chronic poisoning, but they are especially pronounced in the latter. The paralysis of chronic poisoning is, in the majority of instances, the result of a polyneuritis similar to that produced by other toxic agents; in a few cases, however, paralysis of spinal origin has been observed.

**Alimentary Canal.**—In minute doses arsenic stimulates the appetite and favors digestion. Large doses have an irritant effect, and excite colicky pains, vomiting, and diarrhea.

**Effect on Metabolism.**—It is generally conceded that arsenic in therapeutic doses favorably influences nutrition, but the manner in which this is accomplished is not understood. Toxic doses have a profound effect upon tissue-metabolism. They increase proteid disintegration, augment the nitrogenous output, lessen oxidation of the tissues, and cause fatty changes in the epithelium of the alimentary canal, and, to a less extent, in the liver, heart, and kidneys.

**Elimination.**—Arsenic passes out of the body very slowly; most of it escapes in the urine, but traces may be detected in the other secretions.

**Action on Lower Organisms.**—While arsenic will readily kill insects and worms, it is not very destructive to the lowest forms of animal and plant life.

**Toxicology.**—*Acute arsenical poisoning* is characterized by severe abdominal pains, vomiting and purging of "rice-water" and, perhaps, bloody material, persistent thirst, oliguria, muscular cramps, dyspnea, cyanosis, and collapse. Death, which usually occurs in from one to three days, is often preceded by delirium, convulsions, and coma. If recovery follow, the symptoms of acute poisoning may be slowly replaced by those of chronic poisoning. Occasionally cases are encountered in which the symptoms depart somewhat from the usual type; thus there may be a rapid termination in collapse or coma without any preceding abdominal symptoms; sometimes a temporary remission in the symptoms occurs about the third day, and this is followed, as in the case of phosphorus poisoning, by jaundice and delirium; again, there may be, in addition to the abdominal symptoms, an extensive urticarial or vesiculopapular rash.

It is difficult to fix upon the minimum fatal dose of ar trioxid, since much that is ingested often escapes absor According to Taylor, about 2 gr. (0.13 gm.) is the mini fatal dose for an adult; but cases are on record in which large doses, even 1–2 ounces (30.0–60.0 gm.), have swallowed without destroying life.

After death from arsenic macroscopic changes are app in the stomach and upper bowel. The mucous membr swollen, congested, and more or less eroded. Microscop amination of the organs reveals fatty degeneration in th thelium of the alimentary canal, and in the liver, kidney muscles. The erosion of the stomach cannot be the res a local action, since it has occurred after the hypodermic tion of the poison and after its introduction through a w when only minute quantities could have reached the sto Moreover, arsenic lacks the power possessed by cor poisons of uniting with proteid matter to form an albun The action of the drug in inducing cellular death appe be a specific one, and in the present state of our know no satisfactory explanation of it can be given.

*Treatment of Acute Poisoning.*—The stomach shou emptied by means of the stomach-pump or by an emetic. best chemical antidote is the recently prepared ferric hyc or ferric hydroxid with magnesia (see p. 293), admini while still moist, in doses of a tablespoonful or more eve or fifteen minutes. These compounds are in themselves less and act by forming insoluble arsenites. Dialyzed ir it liberates a certain amount of free ferric hydroxid stomach, is also antidotal. As in poisoning from othe tants, diluents, demulcents, and opiates are usually ind

*Chronic arsenical poisoning* may be a sequel of acute p ing, may follow the prolonged use of the drug for me purposes, may result from the use of foods or liquors co inated with arsenic, may occur from the constant inhalat dust arising from wall-paper or other fabrics containing ical pigments, or may be acquired by workers in arsenic or in factories in which fumes of the metal are forme may be manifested by gastro-enteritis, conjunctiviti catarrh of the upper air-passages, anemia, peripheral n and various cutaneous lesions. Polyneuritis from the inal use of arsenic is by no means infrequent. It is commonly observed in children, to whom the drug is given for chorea. Railton has reported 4 cases in whi paralytic phenomena did not appear until from one to weeks after the drug had been discontinued. The

endemic of chronic arsenical poisoning occurring in Manchester, England, in which over 4000 beer-drinkers were affected, was traced to the presence of arsenic in the glucose used for brewing. The sulphuric acid employed in making the glucose contained from 1.4 per cent. to 2.6 per cent. of arsenic trioxid, while the beer contained from ¼ to 3 gr. (0.016–0.2 gm.) per gallon (4.0 L.). In this endemic gastro-intestinal symptoms were not marked, the chief phenomena being numbness and tingling in the hands and feet; a sense of burning in the feet, and painful flushing, resembling erythromelalgia; and certain skin-lesions, consisting of pigmentation resembling Addison's disease, herpes zoster, hyperidrosis, hyperkeratosis of the palms and soles, and pemphigoid eruptions.

Besides hyperkeratosis of the hands and feet, prolonged arsenical medication may result in other lesions of the skin indicative of increased cellular proliferation. Thus it may lead to corns, horny growths, multiple warts, and, perhaps, to epithelioma. Hartzell has collected 11 cases of epithelioma occurring in psoriasis, and apparently due to the prolonged use of arsenic.

**Tolerance.**—Under certain conditions, which are not well understood, the prolonged use of arsenic, instead of causing chronic poisoning, may result in the establishment of a tolerance for the drug. In some parts of Austria it is a custom among many of the peasants to take gradually increasing doses of arsenic, under the belief that it improves the complexion and increases the endurance. According to Knappe, so much as 5 or 6 grains (0.3–0.4 gm.) are sometimes taken at a single dose without harm. The practice, however, even among these peasants, is not altogether free from risk, and in other countries it is the exception, rather than the rule, for the continued administration of arsenic not to be followed by untoward effects.

**Therapeutics.**—Locally, arsenic trioxid is used successfully as a caustic in removing from the skin circumscribed, superficial new growths, such as *lupus* and *epithelioma*, especially the latter. For this purpose a paste made by adding equal parts of the trioxid and acacia to a saturated solution of cocain hydrochlorid is used. This should be spread over the diseased surface, and allowed to remain for from twenty-four to forty-eight hours, when a poultice may be applied to remove the slough. It is generally not advisable to spread the paste over a larger area than a square inch at one time.

Internally, arsenic is employed empirically in a number of quite diverse pathologic conditions. After iron, it is the most

effective drug we have in *anemia.* In *pernicious an* Fowler's solution, although not curative, is our best rem When well borne, the dose should be gradually increase that at the end of three or four weeks the patient is ta from 10–15 min. (0.6–1.0 c.c.) or more, three times a Fowler's solution is also a valuable remedy in *Sydenh chorea* or *St. Vitus's dance.* To be effective, however, it be given in ascending doses until symptoms of satur appear. *Neuralgia* that is dependent upon anemia is benefited by arsenic. In *pulmonary tuberculosis* no ge tonic, with the exception of cod-liver oil, is so service The drug has a long-standing reputation as a remedy in *betes mellitus.* While it is not nearly so efficacious as o it may be tried in the mild forms of the disease. It is a alterative in *chronic rheumatism*, *chronic gout*, and *rheum arthritis.* In *bronchial asthma* it is sometimes very effi although it is not so reliable as potassium iodid. Acco to Murray, it is especially useful in the asthma of childre of old emphysematous persons.

Both Bramwell and Balfour have spoken in the hi terms of the prolonged use of arsenic ($\frac{1}{100}$–$\frac{1}{60}$ gr.—0.0 0.0012 gm.) in *myocardial degeneration* and *angina pe* In these cases it may be combined advantageously strychnin, and sometimes also with digitalis.

In *malaria* it is a useful adjuvant to quinin. It pro exerts no destructive influence upon the parasite, but employed after the subsidence of the paroxysms, it pro valuable blood-restorer.

Arsenic has been found efficacious in certain diseases digestive tract. It is often very useful in that obstinate tion know as "*geographic tongue*," in which whitish, cir patches appear upon the tongue and creep from one p another. In some cases of *gastralgia* it acts most ha Ringer has derived great benefit from the use of Fo solution—a drop shortly before meals—in the *morning ing of drunkards*, and in cases of so-called *irritative dysp* in which the tongue is furred and its papillæ are re prominent. The same treatment is also highly recomm in that form of indigestion which is characterized by an u trollable desire to evacuate the bowel immediately after food.

The administration of arsenic sometimes gives very g ing results in certain chronic inflammatory skin disease sluggish type. It is especially useful in *psoriasis*, *pemp* and *chronic erythematous*, *squamous*, and *papular eczema.*

drug is contraindicated when the inflammatory process is of an acute or active type. It is a common practice to give Fowler's solution in combination with bromids to prevent the outbreak of acne. Ewald has confirmed the observation originally made by Mabille that arsenic obviates to a great extent the unpleasant symptoms excited by thyroid medication.

**Administration.**—As persons vary considerably in their susceptibility to the action of arsenic, it is always well to begin with small doses of the drug and to increase them gradually. Puffiness under the eyes, especially noticeable in the morning, and looseness of the bowels, with colicky pains, are the usual indications of saturation. For pills, arsenic trioxid is generally selected, and for solutions, the solution of potassium arsenite. When a very decided impression is desired, as in chorea and pernicious anemia, the best preparation to employ is Fowler's solution, and this should be prescribed by itself, so that changes in the doses can be readily made from day to day. When arsenic is prescribed for its constitutional effect, it should be given invariably after meals. When it is not tolerated by the stomach, it may be given subcutaneously in the form of sodium arsenate.

The following formulæ will illustrate the manner of prescribing the drug in combination:

℞ Arseni trioxidi, gr. ss (0.03 gm.);
Quininæ sulphatis, gr. I (3.2 gm.);
Ferri reducti, gr. xl (2.6 gm.);
Pulveris capsici, gr. x (0.65 gm.).—M.
Fiant pilulæ No. xx.
Sig. One after meals. (*Malaria after the arrest of the paroxysms.*)

℞ Liquoris potassii arsenitis, f℥iss (5.5 c.c.);
Sodii salicylatis, ℥v (20.0 gm.);
Glycerini, f℥j (30.0 c.c.);
Aquæ menthæ piperitæ, q. s. ad. f℥iv (118.0 c.c.).—M.
Sig. A teaspoonful in water, gradually increased to a dessertspoonful, after meals. (*Diabetes mellitus.*)

**Incompatibles.**—Salts of iron, silver, copper, and ammonium, magnesia, lime, and tannic acid.

**Arseni Iodidum, U. S. P.**—Iodid of arsenic occurs in orange-red, glossy crystals, having the odor and taste of iodin. It is soluble in water and alcohol. The dose is from $\frac{1}{30}$—$\frac{1}{10}$ gr. (0.002–0.006 gm.). It has been found useful in *tuberculous adenitis* or *scrofula*. Saint-Phillippe has employed it with success in the troublesome *bronchitis* of strumous children. He recommends 5 min. (0.3 c.c.) of a 1 per cent. solution, gradually increased to 10–15 min. (0.6–1.0 c.c.), with meals.

Aqueous solutions should be freshly prepared and kept cool place, since they are prone to decompose into arse and hydriodic acids.

**Sodii Cacodylas.**—Sodium cacodylate is an organic pound derived from cacodylic acid or dimethyl arsenic is a soluble, deliquescent, tasteless solid, containing 50 per cent. of arsenic. Like other organic compound arsenic it is only feebly toxic—according to Renaut, 15 gr gm.) injected intravenously into a rabbit does not cause It has been employed medicinally in the same conditio which the inorganic preparations of arsenic have been useful. The dose is from $\frac{1}{3}$–$1\frac{1}{2}$ gr. (0.02–0.1 gm.) hypod cally two or three times a day. T. R. Fraser has shown cacodylates are inert because no dissociating influen which thay are subjected in the tissues is able to lib from them the active arsenic ion. He was never ab the usual tests to detect arsenic in the urine after administration. His experiments prove what might dently have been anticipated, that if arsenic is so firmly with other bodies as to be incapable of producing toxic a it is not capable of producing therapeutic influence. If a istered by the mouth, however, cacodylates may become sonous by meeting with reducing agents in the alimentary Murrell has reported a case of poisoning in a tuberc patient from the administration of sodium cacodylate b mouth in doses of 1 gr. (0.065 gm.) twice daily. The symptoms appeared after the eleventh dose.

**Atoxyl.**—This is an organic compound of arsenic (sodium aminophenyl arsenate) with one hydroxyl radi the acid replaced by a molecule of anilin. It contains 26 per cent. of arsenic. It appears as a white powder h a slightly saline taste, soluble in 6 parts of water. The d from $\frac{1}{3}$ to 1 gr. (0.02–0.065 gm.), hypodermically, every day. Atoxyl acts like other arsenical compounds, but it irritant, and, owing to its slow decomposition, less toxic. capable, however, of producing poisonous effects, and Marie, Bardet, and others have reported a number of ca which more or less serious visual disturbances occurred its administration. It is said to have given good results various conditions in which arsenic generally has been beneficial, and has been especially recommended in *s with marked cachexia* and *sleeping sickness.*

**Liquor Arseni Bromidi.**—This preparation, which known as Clemens' solution, is not, as its name implies, a tion of the bromid of arsenic, since the latter is decompo

the presence of water, but rather a solution of arsenate and bromid of potassium. It is made by boiling 73 gr. (47.3 gm.) each of arsenic trioxid and of potassium bicarbonate in 2 fl. oz. (59.14 c.c.) of water until solution is effected; allowing to cool, adding 10 fl. oz. (295.73 c.c.) of water, then 117 gr. (7.581 gm). of bromin, and finally enough water to make 16 fl. oz. (473.17 c.c.). The solution represents about 1 per cent. of arsenic trioxid. The dose is from 1–5 min. (0.06–0.3 c.c.), well diluted, after meals. It has been largely used in the treatment of *diabetes mellitus*, but with less success than opium, salicylic compounds, or antipyrin.

**Cupri Arsenis.**—Arsenite of copper is a yellowish-green crystalline powder, slowly soluble in water. Under the name of Paris green or Scheele's green it is much used as an insect poison and as a pigment for paper, cotton fabrics, artificial flowers, etc. Cases of poisoning from this salt of copper have been of frequent occurrence. The antidotes are the same as those to arsenic trioxid. The therapeutic dose is from $\frac{1}{300}$–$\frac{1}{100}$ gr. (0.0002–0.00064 gm.), well diluted. It has been very highly recommended as an intestinal antiseptic in the *diarrhea of childhood*, when the stools are copious, green, and offensive.

## POTASSII IODIDUM, U. S. P.

(Potassium Iodide, KI.)

Potassium iodid occurs as colorless, transparent or translucent crystals, or as a white granular powder, having a pungent, saline taste. It is soluble in 0.7 part of water, 2.5 parts of glycerin, and 12 parts of alcohol. The usual dose is from 5–10 gr. (0.3–0.65 gm.), well diluted, thrice daily; but in syphilis often three or four times this amount may be given with advantage.

PREPARATION.

Unguentum Potassii Iodidi, U. S. P. (contains 10 per cent. of potassium iodid and 0.6 per cent. of potassium carbonate).

**Physiologic Action.**—In health a single, moderate dose of potassium iodid produces no demonstrable effects beyond a slight increase in the secretion of urine and, perhaps, some disturbance of the stomach. The drug is rapidly absorbed from all parts of the digestive tract, and reappears in the secretions in less than fifteen minutes after its ingestion. The larger portion is eliminated through the kidneys, but small quantities escape in the saliva, tears, milk, and perspiration. It is likely that a small portion is retained for a time in the body, and that its continuous administration may result in accumulation.

Large doses of potassium iodid cause burning in the stom nausea, vomiting, and diarrhea. The continuous use of drug is usually followed, sooner or later, by a group of sy toms known as *iodism*. This condition has been attribute the irritant effects of free iodin, into which a portion o iodid appears to be converted. Its manifestations are commonly associated with the mucous membrane of the piratory tract and with the skin, and consist of frontal h ache, lacrimation, running at the nose, sneezing, sorenes the throat, an increased flow of saliva, and, later, of a gener acneiform eruption on the skin. More rarely the erupti of an erythematous, purpuric, or bullous character. Pa and intense dyspnea from inflammatory edema of the la have occasionally been observed. In some instances symp suggesting Graves' disease have developed, such as tremor diac palpitation, sweating, and loss of weight. It is not im able that the last-named symptoms owe their origin to fluence exerted by the iodid on the thyroid gland. Pro cachexia, atrophy of the mammæ or testicles, paralysis, and ness have also been reported as occurring from the prol use of iodids. The amount of the drug required to induce i varies considerably in different subjects. Daily doses o 200–300 gr. (13.0–20.0 gm.) are sometimes well borne, a the other hand, doses of from 2–3 gr. (0.13–0.2 gm.) a da soon excite intense discomfort. Russell has reported a which 5 doses of 4 min. (0.25 c.c.) of the syrup of f iodid with 2 gr. (0.13 gm.) of potassium iodid, over a of three days, caused acute iodism with fatal terminatio man of sixty-eight years, suffering from rheumatoid ar Patients with chronic Bright's disease are often extr intolerant. Syphilis does not always confer immunity.

**Therapeutics.**—Potassium iodid is of value in a of morbid conditions, but the study of its action on h subjects has thus far failed to throw much light up manner in which its good effects are accomplished. I effects are observed in *syphilis*, in which disease its effi equal to that of mercury. In the tertiary period it i valuable than mercury, and in the late secondary perio an excellent adjuvant. It should be given in ascending until improvement follows or symptoms of iodism appe secure permanent results, the treatment must be co for six months or a year. In *parasyphilitic affections* motor ataxia, paretic dementia, and arteriosclerosis—th should always be tried, though, of course, no good can from its use if there has been much destruction of tiss

Various opinions are held as to the value of potassium iodid in chronic interstitial inflammations, like *cirrhosis of the liver*, *chronic interstitial nephritis*, and *sclerosis of the spinal cord*, when a syphilitic origin can be excluded. The author is of the opinion that though the drug is of doubtful service, it ought to be tried. Only small doses, however, should be given, and these should be withdrawn on the slightest evidence of intolerance. In *subacute* and *chronic rheumatism* and in *chronic gout* it sometimes proves beneficial. It is generally believed that it aids in the absorption of the effusion in *serous pericarditis* and *pleurisy*. It is the most reliable remedy that we possess in *bronchial asthma* to prevent the return of the paroxysms. In *chronic bronchitis*, when the sputum is composed of thick, viscid mucus, it may be combined advantageously with expectorants.

In doses of from 10–20 gr. (0.65–1.3 gm.) thrice daily it is very beneficial in *aortic aneurysm;* even if it does not retard the progress of the disease, it nearly always lessens the pain. It is said to act by lessening the viscosity of the blood, but this is doubtful. It certainly does not lower the blood-pressure. In *angina pectoris* no remedy with the exception of the nitrites is so useful in preventing recurrence of the attacks. To be effectual it should be given in daily doses of from 30–45 gr. (2.0–3.0 gm.) for several months. According to Osler, the patients who stand the treatment well are the robust, middle-aged men, in whom the angina is the sole symptom.

In *chronic metallic poisoning*, especially from lead and mercury, potassium iodid is apparently efficacious. In large doses continued over long periods of time it has given very good results in many cases of *actinomycosis* in man.

**Administration.**—Individual susceptibility to the iodids varies remarkably and idiosyncrasies are frequently encountered. Children generally bear the drug much better than adults. The initial dose should always be small, and the amount gradually increased as the tolerance of the patient permits. No drug is of much value in preventing iodism when the tendency to it is pronounced, but the tincture of belladonna (3–5 min.—0.2–0.3 c.c.) will sometimes relieve the coryza, and Fowler's solution (1–2 min.—0.06–0.12 c.c.), the acne and indigestion. Iodids should always be given after meals and well diluted. The unpleasant taste can be disguised with compound syrup of sarsaparilla. A convenient method of prescribing potassium iodid is in the form of a saturated aqueous solution, so prepared that 1 min. (0.06 c.c.) will contain 1 gr. (0.065 gm.) of the salt. As prescribing the iodid and

water, ounce for ounce, results in a solution much we
than the one indicated, Hynson suggests the following
Dissolve 480 gr. (31.1 gm.) of the salt in 5½ dr. (20.34
of hot water, and then make up the solution to 8 dr. (29.57
with water. This results in a solution containing 1 gr. (
gm.) to a minim (0.06 c.c.). A drop from a medicine dr
will contain a little less than 1 gr. (0.065 gm.). If tak
milk, most patients do not find the solution disagre
When not tolerated by the stomach, potassium iodid m
given as an enema in milk.

**Incompatibles.**—Mineral acids and salts, alkaloids
spirit of nitrous ether. Potassium iodid is often add
excess to solutions of corrosive sublimate to form the s
double iodid of mercury and potassium.

### SODII IODIDUM, U. S. P.

(Sodium Iodid; NaI.)

Sodium iodid occurs in colorless, cubical crystals or
crystalline powder, of a bitter, saline taste. On expos
moist air it deliquesces and becomes sodium carbonat
free iodin. It is soluble in 0.5 part of water and in 3 pa
alcohol. The dose is from 5–20 gr. (0.3–1.3 gm.) or
well diluted. It has the same therapeutic value as the
sium salt, but it is sometimes better borne by the stoma

### AMMONII IODIDUM, U. S. P.

(Ammonium Iodid; $NH_4I$.)

Ammonium iodid occurs in minute colorless, cubical c
or white granular powder, of sharp, saline taste. On ex
it attracts moisture from the air, and becomes yellowish-
from the loss of ammonia and the liberation of iodin.
soluble in 0.6 part of water and in 9 parts of alcohol
dose is from 3–15 gr. (0.2–1.0 gm.) or more, well
Excepting that it is somewhat more irritating to the st
it has the same properties as potassium iodid.

### STRONTII IODIDUM, U. S. P.

(Strontium Iodid; $SrI_2 + 6H_2O$.)

Strontium iodid occurs in colorless or faintly yello
agonal plates, deliquescent, and of bitterish, saline taste
soluble in 0.5 part of water. The dose is from 5–20 g
1.3 gm.) or more, well diluted. While less irritating a
prone to induce iodism than potassium iodid, it does n
to be so powerful as the latter salt.

### PLUMBI IODIDUM, U. S. P.

(Lead Iodid; $PbI_2$.)

Lead iodid is a heavy, bright yellow powder, odorless and tasteless, and permanent in the air. It is almost insoluble in water. The dose is from ½–3 gr. (0.03–0.2 gm.).

PREPARATION.

Unguentum Plumbi Iodidi (10 per cent.).

Iodid of lead is rarely used internally. Externally the ointment makes an excellent resolvent application for *tuberculous lymphatic glands* and other forms of *non-suppurative adenitis*. It should be applied very thoroughly and with gentle friction.

### ACIDUM HYDRIODICUM.

(Hydriodic Acid; HI.)

Hydriodic acid is official as diluted hydriodic acid (*Acidum Hydriodicum Dilutum*, U. S. P.), which contains 10 per cent. by weight of the absolute acid, and as the syrup of hydriodic acid (*Syrupus Acidi Hydriodici*, U. S. P.), which contains 1 per cent. by weight of the absolute acid. The action of these preparations is feeble, but resembles that of the iodids. The dose of the diluted acid is from 5–10 min. (0.3–0.6 c.c.), and of the syrup ½–2 fl. dr. (2.0–8.0 c.c.).

### IODUM, U. S. P.

(Iodine; I.)

Iodin is a non-metallic element obtained chiefly from the ashes of seaweed. It occurs in heavy, bluish-black, friable crystals, having a metallic luster, a peculiar odor, and a sharp, acrid taste. On heating it emits a violet-colored vapor. It is soluble in 5000 parts of water, in 10 parts of alcohol, and freely soluble in ether, chloroform, and solutions of potassium iodid.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Iodi, U. S. P. (7 per cent.) | 1–5 min. (0.06–0.3 c.c.). |
| Liquor Iodi Compositus, U. S. P. (Lugol's solution: 5 per cent. of iodin in a 10 per cent. solution of potassium iodid) | 1–10 min. (0.06–0.6 c.c.). |
| Unguentum Iodi, U. S. P. (4 per cent. of iodin and 4 per cent. of potassium iodid). | |

**Physiologic Action.**—When applied to the skin, iodin stains it a yellowish-brown color and causes burning and itching. Strong solutions produce vesication. Mucous membranes are especially sensitive to its irritant action. Injections beneath the skin or into serous sacs excite intense pain and

severe inflammatory reaction. When taken internally, rapidly absorbed in the form of iodids and soon reappe all the secretions of the body. The bulk of it is elimina the urine, also in the form of iodids. In medicinal doses exerts the same influence as potassium iodid, and if giver tinuously, induces all the phenomena of *iodism* (p. 314). large doses produce gastro-enteritis, respiratory failure collapse. Anuria and albuminuria have also been obs Cases of fatal poisoning have been reported from its inj into large cysts and also from its too free use externally.

The *treatment of acute iodin-poisoning* consists in evac the stomach, administering starch or starchy foods (flour, root) as antidotes, and maintaining the respiration and c tion by hypodermic injections of alcohol, strychnin, di and ammonia.

**Therapeutics.**—Iodin is a useful counterirritant i ditions requiring a mild but persistent effect. The t may be applied externally in *pleurisy*, *bronchitis*, *lar synovitis*, *arthritis*, *neuritis*, *muscular rheumatism*, and inflammatory affections. It is best applied by mean camel's-hair brush, one or two coats being painted o part at intervals of a day or two. For children it sho diluted with 2 or 3 parts of alcohol. If the application too painful, the iodin should be removed with dilute a or, better, with a solution of potassium iodid, and t dressed with starch jelly.

Preparations of iodin are very efficacious in bringing resolution in various forms of *adenitis* provided they are early and before suppuration has commenced. A bro may be painted with the tincture around the swelling, ointment may be thoroughly rubbed into it. A bett however, and one less likely to produce painful derm to rub in a mixture of equal parts of the ointments o donna and of lead iodid, and then to apply firm con pressure by means of a pad and a bandage.

*Ganglion*, *hydrocele*, *housemaid's knee*, and *spinal m cele* are often successfully treated by evacuating the f then injecting tincture of iodin into the sac. Iodin was f much used, both internally and externally, in the treat *simple goiter*, but thyroid extract has been found more eff Injections of tincture of iodin are sometimes of value i ing *cystic goiter*. From 3–5 min.. (0.2–0.3 c.c.) shoul jected into different parts of the tumor at intervals of four days. Local applications of iodin have long been high repute in certain chronic catarrhal processes atte

glandular hypertrophy, such as *rhinitis*, *pharyngitis*, and *endometritis*.

In *chilblain* an application of tincture of iodin and glycerin, equal parts, acts very favorably. Iodin has been used internally in the form of Lugol's solution in *syphilis*, *tuberculous adenitis*, and *goiter*, but on account of its irritant properties it is far less serviceable than the iodids.

Various attempts have been made to lessen the irritant effects of iodin by combining it with albumin or fat. The preparation known as *iodipin* represents, perhaps, the most successful of these attempts. It is an addition-product of iodin (10 per cent. or 25 per cent.) and oil of sesame, which, according to Winternitz, is not decomposed in the stomach, but in the intestine. The 10 per cent. preparation is administered by the mouth in doses of ½–2 fl. dr. (2.0–8.0 c.c.). It is generally well borne, but its oily taste frequently proves objectionable. The 25 per cent. iodipin is used for subcutaneous injection, about ½–1 fl. dr. (2.0–4.0 c.c.), slightly warmed, being injected daily between the skin and muscle of the gluteal region.

**Incompatibles.**—Alkaloids, mineral salts, ammonia, carbonates, starch, and mucilage of acacia. It acts violently upon turpentine and many other volatile oils. Tincture of iodin is also incompatible with aqueous preparations. In the so-called "colorless solutions of iodin" the iodin is replaced by iodids.

## IODOFORMUM, U. S. P.

(Iodoform; $CHI_3$.)

Iodoform, or tri-iodid of methane, is methyl with 3 atoms of hydrogen displaced by 3 of iodin. It is made by heating in a closed vessel iodin, alcohol, sodium hydrate, and water. It occurs in small, yellow, hexagonal crystals, having a peculiar penetrating odor, and a sweetish, iodin-like taste. It is freely soluble in ether, chloroform, and oils, soluble in about 47 parts of alcohol, and very feebly soluble in water. It contains more than 95 per cent. of iodin. The dose is from 1–3 gr. (0.06–0.2 gm.) in pill.

PREPARATION.

Unguentum Iodoformi, U. S. P. (10 per cent.).

**Physiologic Action.**—Upon mucous membrane and raw surfaces, especially the latter, iodoform acts as a mild anesthetic. It is readily absorbed from wounded surfaces, partly as iodin, which it liberates in the presence of moist organic matter, partly as albuminous compounds of iodin, and partly, probably, as iodoform. Shortly after absorption iodin appears

in all the secretions; elimination, however, is mainly eff through the kidneys, which slowly excrete the drug in the of iodids. When absorbed too freely it induces an intoxica which not infrequently proves fatal. The symptoms of po ing somewhat resemble those of cerebral meningitis, and in malaise, headache, mental depression, contraction of the p the taste of iodoform in the mouth, nausea and vomiti very rapid pulse, delirium with hallucinations, stupor, and In some cases there has been, in addition, high fever, a others, a diffuse erythematous rash. Postmortem examir shows fatty degeneration of the organs and sometimes co tion of the cerebral meninges. As neither iodin nor iod overdoses cause cerebral symptoms, it is probable tha latter result from the action of iodoform itself. Old, a patients, especially sufferers from Bright's disease, are readily poisoned than the young and robust.

Although the favorable action of iodoform on in wounds can no longer be disputed, the manner of its ope is still obscure. It has little or no germicidal power, may act by retarding germ-growth through the iodin w liberates, by inhibiting serous exudation and thus dep the organisms of nourishment, or by neutralizing the formed by bacteria.

In some persons the local application of iodoform irritating, and gives rise to a severe pustular or erythen eruption.

**Treatment of Poisoning.**—The indications are to su the applications, to sustain the strength of the patien to favor elimination of the drug by means of subcut injections of normal salt solution and the administrat alkaline diuretics.

**Therapeutics.**—Iodoform is extensively employed local application in *infected wounds*. In various *ulcers*— itic, chancroidal, and tuberculous—it is very efficient. form of iodoform gauze it makes an excellent packing fo *wounds*, *sinuses*, *fistulæ*, and the *rectal*, *vaginal*, and *nas ities*. *Cold abscesses* and *tuberculous joints* are often succe treated by injecting into them, once a week, iodoform cent.) in sterile olive oil or glycerin or iodoform (5 pe in ether, to the amount of $\frac{1}{2}$–3 fl. oz. (15.0–90.0 c.c.) iodoform should always be sterilized by soaking it for days in a solution of 1 : 1000 of corrosive sublimate a thoroughly washing in sterilized water.

As a local analgesic it is particularly useful in reliev pain and dysphagia of *tuberculous laryngitis*, in which a

it may be employed by insufflation, either in pure form (2–3 gr.—0.13–0.2 gm.) or mixed with morphin ($\frac{1}{16}$–$\frac{1}{12}$ gr.—0.004–0.005 gm.). Suppositories of iodoform (3 gr.—0.2 gm.) are of service in *painful hemorrhoids* and in *fissure of the anus.*

Semmola, Dreschfeld, Foxwell, and others have spoken very highly of the internal use of iodoform (6–12 gr.—0.4–0.8 gm. daily) in *pulmonary tuberculosis*, but the treatment has gone out of vogue. While many agents have been recommended for disguising the disagreeable odor of iodoform, none has proved very successful; the best, however, are the volatile oils, such as bergamot, fennel, anise, and cumarin, the odorous principle of Tonka bean.

### IODOLUM, U. S. P.

(Iodol; Tetra-iodo-pyrrol; $C_4I_4NH$.)

Iodol is prepared by acting upon pyrrol, a principle obtained from bone oil with iodin. It contains a little less than 90 per cent. of iodin, and appears as a yellowish, crystalline powder, free from odor and taste. It is almost insoluble in water, but it is freely soluble in alcohol, ether, and oils.

It is used as a substitute for iodoform. Though much more costly than the latter, it has a decided advantage in being odorless.

### THYMOLIS IODIDUM, U. S. P.

(Thymol Iodid; Di-thymol-di-iodid; Aristol; $C_{20}H_{24}O_2I_2$.)

Thymol iodid, or aristol, is obtained by acting upon thymol in alkaline solution with iodin dissolved in potassium iodid. It contains about 45 per cent. of iodin, and appears as a brownish-red powder, tasteless and almost odorless. It is readily soluble in ether and oils, but it is insoluble in water. It is decomposed by heat, light, acids, alkalis, alcohol, and corrosive sublimate.

It is employed as a substitute for iodoform. While it has advantages in being odorless and less toxic than iodoform, it is more unstable, more costly, and less effective. It may be applied pure or dissolved in ether or oil.

### EUROPHEN.

(Di-isobutyl-ortho-cresol-iodid; $C_{22}H_{29}O_2I$.)

Europhen is obtained by precipitating an alkaline solution of isobutyl-ortho-cresol with a solution of iodin in potassium iodid. It contains 28 per cent. of iodin, and appears as a very bulky, yellow, amorphous powder, of an aromatic odor. It is insoluble in water and glycerin, but freely soluble in alcohol, ether, and oils. It is a good substitute for iodoform.

### NOSOPHEN.

(Tetra-iodo-phenol-phthalein; $(C_6H_2I_2OH)_2C_8H_4O_2$.)

Nosophen is obtained by the action of iodin on a sol of phenol-phthalein. It is a pale yellow, inodorous, and less powder. It contains 60 per cent. of iodin. With ba forms salts, the most important of which is the sodiur (*antinosin*). It differs from iodoform in being an active septic and in not yielding its iodin to the tissues.

## HYDRARGYRUM, U. S. P.

(Mercury; Quicksilver; Hg.)

Mercury is a heavy, liquid metal, of a silvery luste without odor or taste.

**Physiologic Action.**—When small doses of an unirr preparation of mercury are given continuously for a length of time, the first effects are observed in the r There are increased flow of saliva, fetor of the breath, so of the teeth when the jaws are brought forcibly togethe redness of the gums near the insertion of the teeth. drug is not withdrawn, salivation becomes excessive, the become swollen and spongy, the teeth loosen and fall o tongue and parotid glands enlarge,—the former someti such an extent that it protrudes from the mouth,—and the soft tissues become ulcerated and the bones ne The term *ptyalism* is applied to this group of symptom the same time the general health is more or less affecte patient becomes pale and loses flesh. Fever, chilliness, anorexia, nausea, vomiting, and purging may appear.

The mercuric salts are more irritant and poisonous th mercurous salts. The ingestion of a large dose of one former (corrosive sublimate) is speedily followed by burning in the esophagus, stomach, and abdomen, v and purging of mucous and bloody material, anuria, or i with albuminous urine, and profound collapse. Subseq if the patient survive the corrosive effects of the drug, p may develop from the absorption of the metal into the tion. After death from acute mercury poisoning the r membrane of the alimentary canal is intensely inflam often deeply eroded. A diphtheric condition is son observed. The kidneys are peculiarly affected. In a to the evidences of acute parenchymatous degeneration, of lime are found in the uriniferous tubules, especially t voluted ones. These chalky deposits, while not nomonic of mercurial poisoning, are very suggestive

Chronic mercurial poisoning is most frequently met

workmen who handle the metal or who are exposed to its fumes. Thus it occurs in makers of thermometers, mirrors, and scientific instruments. Occasionally it is induced by the prolonged use of mercury as a medicine. Its chief manifestations are anemia, loss of flesh and strength, mental impairment, tremors similar to those of multiple sclerosis, motor palsies without atrophy of the muscles, gastro-intestinal disturbances, stomatitis, and salivation.

The form in which mercury is absorbed has not been definitely determined, but it is probable that the soluble preparations, at least, enter the circulation in the form of an albuminate. The metal is slowly eliminated through all the emunctories, but especially through the kidneys and bowel.

In medicinal doses the insoluble preparations of mercury act as cathartics (see p. 209), producing copious, loose stools without much griping. They also increase the flow of urine (see p. 233), probably by directly stimulating the renal epithelium. It is generally assumed that they stimulate also the hepatic cells, and thus increase the flow of bile, but recent investigations have shown that they have no such action. Mercurials, especially when locally applied, have a decided influence upon inflammatory exudations of a serous or fibrinous character, often aiding materially in their solution and reabsorption. That they have power to prevent or to lessen the outpouring of inflammatory material is very doubtful. There is reason for believing that the bichlorid in minute doses ($\frac{1}{100}$–$\frac{1}{50}$ gr.—0.0006–0.001 gm.) causes an increase in the number of red blood-corpuscles, when the latter have been reduced from overwork, acute disease, or hemorrhage. Soluble forms of mercury, owing to the avidity with which they unite with proteids, are very destructive to bacteria and other low forms of life. Finally, the drug exerts a specific influence in syphilis, but the manner of its action is unknown.

**Untoward Effects.**—Certain persons are exceedingly susceptible to the influence of mercury. A dose of less than a grain (0.065 gm.) of calomel has been known to excite severe stomatitis, persisting for several weeks. An erythematous or eczematous rash occasionally follows its administration by the mouth or its application to the skin. Calomel should not be applied to mucous membranes or be taken internally while the patient is under the influence of potassium iodid, since the latter is eliminated in all secretions and readily forms with mercurous compounds the irritant mercuric iodid.

**Treatment of Poisoning.**—Ptyalism.—The administration of mercury should be suspended as soon as the slightest tenderness of the gums manifests itself. The mouth should be

frequently rinsed with a saturated solution of potassium c
rate. In severe cases the affected parts may be painted
slightly diluted sulphurous acid or with a saturated solu
of iodoform in ether. To check the excessive flow of sa
atropin ($\frac{1}{120}$ gr.—0.0005 gm.) may be given once or twi
day. Morphin may be required at night to relieve pain
to secure sleep. Potassium iodid is recommended to a
the elimination of the mercury. Tonics may be neede
combat the anemia and exhaustion.

**Acute Poisoning.**—After evacuating the stomach,
albumen should be administered freely as an antidote. O
is often required to allay the pain.

**Chronic Poisoning.**—The patient should be removed
the influence of the metal. Potassium iodid should be giv
aid the elimination of the poison, and tonics to overcom
cachexia. Baths, massage, and electricity are useful adju

**Therapeutics.**—Mercury is used as an antisyphili
germicide, a cathartic, a diuretic, and an absorbent.

**Antisyphilitic.**—Mercurials and iodids are the rem
relied upon to combat syphilis. Mercury should be giv
soon as the diagnosis can be made with certainty, and
tinued throughout the secondary stage. In the tertiary
iodids are generally more serviceable, but mercury is not
out effect, and a combination of the two drugs is ofte
ployed with advantage. When very prompt effects are
sary, mercury should be given the preference. No
which preparation of the metal is selected it should be
in ascending doses until the limit of tolerance is reached,
the dose should be cut down one-third or one-half, an
amount continued for a year or a year and a half. At th
of this time an iodid should be added, and the combi
continued for about another year. The preparations o
cury most frequently prescribed in syphilis are the pro
biniodid, bichlorid, and mercury with chalk.

**Germicide.**—The soluble preparations of mercury, alt
among the most powerful germicides known, have
drawbacks. Thus they are highly toxic, they are irrita
the tissues, they are destructive to metal instruments,
the presence of albuminous matters they are readily cor
into insoluble and inert albuminates. Notwithstanding
drawbacks they are the most popular germicides for
surgical work. Of the soluble salts, the bichlorid is
chosen.

**Cathartic.**—Certain insoluble preparations of mer
calomel, blue mass, mercury with chalk—have just
irritant action on the bowel to induce catharsis. They

suitable remedies for habitual constipation, but on account of their thorough and agreeable action they are well adapted for unloading the bowel in dyspeptic diarrhea and in the beginning of acute infectious diseases.

**Diuretic.**—Mercury in the form of calomel or blue mass is an active diuretic, and one that is well suited for carrying off dropsical effusions resulting from cardiac or hepatic disease.

**Absorbent.**—Ointments of mercury are very efficacious in promoting the absorption of the exudation thrown out in certain subacute and chronic inflammations. They are extensively employed for this purpose in synovitis, thecitis, arthritis, adenitis, and orchitis. It need scarcely be said that they are of no value in purulent inflammation.

**Administration.**—Mercurial preparations may be given by the mouth, by inunction, by subcutaneous injection, or by fumigation.

**By the Mouth.**—This is usually the best method of administration when mercury is employed for its constitutional effects. Blue mass, mercury with chalk, mercurous chlorid (calomel), mercuric chlorid (corrosive sublimate), mercurous iodid, and mercuric iodid, are the compounds most frequently chosen for exhibition by the mouth. The insoluble preparations are generally prescribed in pills or tablets. Corrosive sublimate may be given in solution or in pills or tablets. The biniodid is soluble in a solution of potassium iodid.

**By Inunction.**—This method of administering mercury is useful when the stomach is irritable or when it is deemed desirable to hasten mercurialization. The method has disadvantages in being uncleanly, troublesome, and uncertain as to dosage. About 1 dr. (4.0 gm.) of blue ointment may be rubbed into the groins, axillæ, or inner surface of the thighs and arms once a day. In order to avoid local irritation a different region should be selected each day. For infants an ointment may be used consisting of 1 part of mercurial ointment and from 6 to 8 parts of lard. A piece of this the size of a hickory-nut may be spread every day upon a flannel binder which is worn around the abdomen.

**By Subcutaneous Injection.**—Mercury may be given hypodermically in syphilis when a very rapid impression is necessary, or when other modes of administration have proved unsuccessful. This method is not suitable for ordinary cases. The injections are painful and are not unattended with danger. Local complications—induration, abscess, sloughing—are liable to occur, and grave ptyalism may develop, especially in patients with chronic nephritis. Soluble preparations only should be employed. Insoluble preparations may accumu-

late in the tissues for a time, and later give rise to se constitutional symptoms. The best salts for hypode use are the bichlorid and succinimid. From 20 to 30 injections should be made deep into the back or but The initial dose of the bichlorid should not exceed (0.008 gm.), and this amount should be gradually incre to a maximum of ¼ gr. (0.016 gm.). The injections shou given through a platino-iridium needle which has been viously sterilized.

**By Fumigation.**—This method is sometimes employ syphilis instead of inunction, when the stomach is intol It is especially useful when the cutaneous lesions prove nate. The mercurial salt, preferably calomel, of which 20 gr. (1.3 gm.) are used, may be volatilized from a tin suspended over a spirit-lamp. The latter is placed un stool or cane-seated chair, upon which is seated the pa disrobed and surrounded by a blanket fastened to the In about fifteen or twenty minutes the calomel is volat and deposited on the skin as a fine dust. The baths s be given just before retiring, and the sublimated mercury s be allowed to remain on the skin until the next mo The treatment may be continued until slight tenderness gums develops.

**Blue Mass** (Massa Hydrargyri, U. S. P.).—This is a rate of metallic mercury with honey of rose, glycerin, lic and althæa, containing 33 per cent. of the metal. The d from ½–10 gr. (0.03–0.6 gm.). It is employed as a cat and diuretic. In the condition known as "*biliousnes* treatment is so successful as the administration of a blu (5 gr.—0.3 gm.), followed in the morning by Epsom salt Seidlitz powder. In the beginning of *acute febrile diseas dyspeptic diarrhea* blue mass is an excellent cathartic f loading the bowel without inducing irritation. In cor tion with powdered digitalis and squill it is an efficie retic in the dropsy of *chronic heart* and *liver disease.*

**Mercury with Chalk** (Hydrargyrum cum Creta, U. —This is a light-gray, damp powder, without odor, an sweetish taste. It contains 38 per cent. of mercury inti mixed with chalk, honey, and water. The dose is fron gr. (0.03–0.6 gm.). It is used in the same class of ca blue mass. It is particularly serviceable in the *diarrh children* when the tongue is heavily coated, the breath and the stools are greenish or clay-colored. Hutc highly recommends mercury with chalk, in doses o 1–4 gr. (0.065–0.26 gm.), thrice daily, as a convenie efficient form in which to administer mercury in syphil

*congenital syphilis* from ¼–to 1 gr. (0.016–0.065 gm.) may be given three times a day.

**Ointments of Mercury.**—The U. S. Pharmacopœia of 1900 recognizes two ointments: Mercurial ointment (*Unguentum Hydrargyri*) and blue ointment (*Unguentum Hydrargyri Dilutum*). Mercurial ointment contains 50 per cent. of metallic mercury and 2 per cent. of oleate of mercury, 25 per cent. of lard, and 23 per cent. of suet. Blue ointment contains 67 per cent. of mercurial ointment (33 per cent. of metallic mercury) and 33 per cent. of petrolatum. These preparations are employed as antisyphilitics, absorbents, and parasiticides. In syphilis they are administered by inunction. In *synovitis*, *bursitis*, *rheumatic arthritis*, *glandular enlargements*, and *syphilitic nodes* they are valuable as absorbents. When the swelling is painful, an equal amount of belladonna ointment may be added for its sedative effect. In *subacute rheumatism* the local application to the affected joints of an ointment containing mercury and salicylic acid is often efficacious.

℞ Acidi salicylici, gr. xxx (2.0 gm.);
Olei terebinthinæ, f℥iiss (10.0 c.c.);
Adipis lanæ hydrosi, ℥ss (15.0 gm.);
Unguenti hydrargyri, ℥j (30.0 gm.). M.
Sig. Apply with gentle friction night and morning.

In *pediculosis pubis* the parasites are quickly destroyed by rubbing into the affected parts a small amount of blue ointment.

**Mercurial Plaster** (Emplastrum Hydrargyri, U. S. P.).—This is a plaster containing 30 per cent. of metallic mercury, 1 per cent. of oleate of mercury, 10 per cent. of hydrous wool-fat, and 59 per cent. of lead-plaster. It is employed as an absorbent in *chronic inflammatory swellings*, *glandular enlargements*, *syphilitic nodes*, etc., but is far less efficient than the ointment.

### HYDRARGYRI CHLORIDUM CORROSIVUM, U. S. P.

(Mercuric Chlorid; Corrosive Sublimate; Bichlorid of Mercury; $HgCl_2$.)

Mercuric chlorid appears in the form of colorless, odorless crystals, having an acrid, metallic taste. It is soluble in 13 parts of water and in 3 parts of alcohol. The dose is from $\frac{1}{10}$–$\frac{1}{2}$ gr. (0.0006–0.005 gm.).

**Therapeutics.**—Corrosive sublimate is employed chiefly as a germicide, an antisyphilitic, and a tonic.

**Germicide.**—It is an energetic germicide, capable of destroying most bacteria even in solutions of 1 : 20,000, and their spores in solutions of 1 : 10,000. Some micro-organisms, however, like the bacillus of anthrax, are much less susceptible to

its action. In the presence of hydrogen sulphid it is verted into an insoluble and inert sulphid of mercury; albuminous matter it forms an impermeable albuminate, w prevents its further penetration; it has a corroding actio metal; it is irritating to the tissues, and when applied freely to wounds or mucous membranes, it may be abso in sufficient quantity to induce poisoning. Notwithstan these drawbacks, most surgeons accord corrosive subli the first rank among germicides for use upon the *skin o patient and the hands of the operator*, and *for irrigatin fected wounds and cavities.* On account of its irritant pr ties it should not be used on serous membranes. Fo patient's skin and surgeon's hands a solution of from 1 : to 1 : 500 should be employed; for large wounds and ca 1 : 10,000 to 1 : 5000; for small wounds, 1 : 2000; for irrig the bladder and vagina, 1 : 20,000 to 1 : 5000; for irrig the urethra, 1 : 40,000 to 1 : 20,000; and for irrigatin conjunctiva, 1 : 5000. Tartaric or citric acid may be a tageously combined with bichlorid solutions to preven mercuric salt from forming an insoluble albuminate wit albuminous matter of the tissues. Compressed tablets, containing 7½ gr. (0.48 gm.) of the salt with tartaric aci in common use. One of these added to a pint of water r a solution of 1 : 1000. Ordinary water, on account of th which it contains, partially precipitates corrosive sublim the form of an oxid of mercury. This precipitation, ho can be prevented by adding common salt to the water chlorid solutions cannot be used for sterilizing metal i ments. As a household disinfectant mercuric chlori several disadvantages. It is very poisonous; it has a c ing action on metals; it becomes ineffective by contac albuminous matters; and it renders indelible any sta feces or blood that may be on clothing. Solutions o 1 : 5000 to 1 : 1000, however, are serviceable for scr floors, wood-work, and bare walls. It is not a suitable fectant for sputum, feces, or other albuminous matters.

As a parasiticide, corrosive sublimate is a useful rem *pediculosis pubis* and *ringworm.* In these affections it n employed in the form of a lotion in the strength of fro gr. (0.13–0.26 gm.) to the ounce (30.0 c.c.) of water, or, tincture of benzoin.

The following solution, recommended by Jacobi, m used as a local remedy in *diphtheria:*

℞ Hydrargyri chloridi corrosivi, gr. 1¼ (0.08 gm.);
Sodii chloridi, gr. xl (2.6 gm.);
Aquæ, Oj (0.5 L.). M.

In nasal diphtheria this solution should be warmed and poured into the nares or from a nasal cup several times a day.

Before the introduction of antitoxin, mercury, in the form of calomel or of corrosive sublimate, was extensively used internally in the treatment of diphtheria. It seems to have some value in this affection, but the manner of its action is unknown. Children bear the drug remarkably well, and $\frac{1}{40}$ gr. (0.0015 gm.) of corrosive sublimate, gradually increased to $\frac{1}{20}$ gr. (0.003 gm.), may be given every three or four hours to a child of five years.

Compresses wrung out of bichlorid solutions (1 : 5000) are useful in *erysipelas* and in *small-pox*.

**Antisyphilitic.**—Corrosive sublimate, though somewhat more irritant than the protiodid, is a reliable salt of mercury for use in syphilis. It may be administered either in pill or in solution. One-twentieth of a grain (0.003 gm.), gradually increased to $\frac{1}{12}$ gr. (0.005 gm.), may be given three times a day after meals. The addition of a small amount of opium will usually serve to allay any gastric or intestinal irritation. In the late secondary period the bichlorid may be prescribed with potassium iodid, as in the following formula:

℞ Hydrargyri chloridi corrosivi, gr. iss–ij (0.1–0.13 gm.);
Potassii iodidi, ʒiv–vj (15.0–23.0 gm.);
Syrupi sarsaparillæ compositi, f ʒiss (45.0 c.c.);
Aquæ, q. s. ad f ʒiij (90.0 c.c.). M.
Sig. A teaspoonful in water after meals.

Corrosive sublimate is one of the best salts of mercury for hypodermic use. Sodium chlorid should be added to the solution to prevent the formation in the tissues of an insoluble albuminate.

℞ Hydrargyri chloridi corrosivi, gr. vj (0.4 gm.);
Sodii chloridi, gr. xl (2.6 gm.);
Aquæ destillatæ, f ʒj (30.0 c.c.). M.
Sig. Inject 5–20 min. (0.3–1.2 c.c.) daily.

**Tonic.**—Mercuric chlorid, in doses of $\frac{1}{100}$–$\frac{1}{80}$ gr. (0.0006–0.001 gm.), is sometimes useful as an adjuvant to iron in secondary anemia.

**Incompatibles.**—Corrosive sublimate has a wide range of incompatibilities. The most common substances precipitated by it are tannic acid, alkaline carbonates, albumin, iodids, silver nitrate, and solutions of lime. With potassium iodid it forms mercuric iodid, but if the potassium salt is present in excess, a colorless solution of the double iodid of mercury and

potassium at once results, so that a combination of the drugs is perfectly admissible.

**Yellow wash** (lotio flava) is made by adding 2 (1.6 gm.) of mercuric chlorid to 16 ounces (474.0 c.c.) of water. Yellow mercuric oxid is precipitated and ca chlorid remains in solution. It is sometimes employed stimulating dressing in the treatment of *phagedenic ve sores.*

### HYDRARGYRI CHLORIDUM MITE, U. S. P.

(Mild Mercurous Chlorid; Calomel; HgCl.)

Calomel is a white, odorless, tasteless powder, insolu all ordinary menstrua. The dose is from $\frac{1}{10}$–10 gr. (0. 0.65 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Pilulæ Catharticæ Compositæ, U. S. P. (contains 1 gr. —0.06 gm.). . . . . | 1–3 pills. |

**Therapeutics.**—Calomel is used internally as a ca (see p. 209), as a diuretic (see p. 232), as an antiphlogist as an antisyphilitic. Externally it is employed as a stin desiccant, and antiseptic.

**External Use.**—Zinc ointment to which calomel (5- to the ounce—0.4–1.0 gm.) has been added makes an lent application in *subacute and chronic eczema.* A d powder composed of equal parts of calomel and zinc effective in *venereal warts.* Calomel is also efficacious *neal ulcers* and *phlyctenular conjunctivitis* when there much ciliary irritation. It should be flicked into the gently tapping a camel's-hair brush loaded with the po

**Antiphlogistic.**—Some practitioners believe that cal of service in limiting fibrinous exudation in *inflammat eases of the serous membranes.* For this purpose it ha much used in pleurisy, meningitis, iritis, and pericardi its beneficial effects are very doubtful.

**Antisyphilitic.**—Calomel has been used internally t bat syphilis, but the protiodid and the bichlorid ar dedly preferable, since they do not induce salivat quickly. It is a suitable preparation, however, for vo tion when the patient is to be treated by fumigation. surgeons have recommended deep injections of oily m of calomel in syphilis, but grave symptoms have occa resulted from its use in this way.

**Incompatibles.**—Calomel is incompatible with

chloric acid, chlorates, chlorids, iodids, bromids, and lime-water. With hydrocyanic acid and potassium cyanid it forms the highly poisonous bicyanid of mercury. Mixtures of calomel and iodoform turn red from the formation of mercuric iodid.

**Black wash** (lotio nigra) is made by adding 1 dr. (4.0 gm.) of calomel to 1 pint (0.5 L.) of lime-water. Black mercurous oxid is precipitated and calcium chlorid remains in solution. It is sometimes employed as a stimulating application in *venereal sores*. It is often very useful in *rhus poisoning* and *acute eczema*, when dabbed on the parts, allowed to dry, and followed by an application of zinc ointment.

### HYDRARGYRI IODIDUM RUBRUM, U. S. P.

(Red Mercuric Iodid; Biniodid of Mercury; $HgI_2$.)

Red iodid of mercury is a bright-red, amorphous powder, free from odor and taste. It is almost insoluble in water, soluble in 116 parts of alcohol, and freely soluble in solutions of potassium iodid. The dose is from $\frac{1}{50}$–$\frac{1}{12}$ gr. (0.0012–0.005 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Liquor Arseni et Hydrargyri Iodidi, U. S. P. (Donovan's solution: 1 per cent. of each iodid) | 1–5 min. (0.06–0.3 c.c.). |

**Therapeutics.**—In its effect and strength the biniodid of mercury resembles the bichlorid. In the *late secondary stage of syphilis* it is often of value when given in a solution of potassium iodid, as in the following formula:

℞ Hydrargyri iodidi rubri, gr. j (0.065 gm.);
Potassii iodidi, ʒij–iv (8.0–15.0 gm.);
Aquæ, fʒij (60.0 c.c.);
Syrupi sarsaparillæ compositi, q. s. ad fʒiv (120.0 c.c.). M.
Sig. A dessertspoonful in water after meals.

Donovan's solution is used internally as an alterative in *chronic rheumatism*, *tuberculous adenitis*, and *tertiary syphilis*.

### HYDRARGYRI IODIDUM FLAVUM, U. S. P.

(Yellow Mercurous Iodid; Protiodid of Mercury; Green Iodid of Mercury; HgI.)

Protiodid of mercury is a yellow, amorphous, insoluble powder, free from odor and taste. The dose is from $\frac{1}{10}$–$\frac{1}{2}$ gr. (0.006–0.03 gm.).

**Therapeutics.**—The protiodid of mercury is far less irritant than the biniodid. Ordinarily, it is the best preparation

for use in *syphilis*. It should be given in pills to which a opium may be added if it excite colic or diarrhea.

### HYDRARGYRI NITRAS.

(Mercuric Nitrate; $Hg(NO_3)_2$.)

Mercuric nitrate is official in two forms:

Liquor Hydrargyri Nitratis, U. S. P. (contains 60 per cent. of mercur nitrate and 11 per cent. of free nitric acid).
Unguentum Hydrargyri Nitratis, U. S. P. (citrine ointment: contains per cent. of mercuric nitrate).

**Therapeutics.**—The solution of mercuric nitrate is a erful caustic. It is extensively employed for the cauteriz of *mucous patches* and *sloughing venereal sores*. The d of inducing salivation from using it too freely must be in mind. Citrine ointment, more or less diluted, may be as a stimulant application in *indolent ulcers* and *chronic ec* Diluted with 8 parts of petrolatum it makes an efficient cation for *granulating venereal ulcers*.

### HYDRARGYRUM AMMONIATUM, U. S. P.

(Ammoniated Mercury; Mercuric Ammonium Chlorid; White Precipi $NH_2HgCl$.)

Ammoniated mercury is made by the action of ammo corrosive sublimate, and appears as a white, insoluble p free from odor and taste.

PREPARATION.

Unguentum Hydrargyri Ammoniati, U. S. P. (10 per cent.).

**Therapeutics.**—Ammoniated mercury is employed nally, in the form of the ointment, as a stimulant and parasiticide. It is often serviceable in *chronic eczema*, *ps* and *ringworm*. The official ointment, however, is too for ordinary use, a strength of from 20–30 gr. (1.3–2.0 g the ounce (30.0 gm.) being quite sufficient.

### HYDRARGYRI CYANIDUM.

(Mercuric Cyanid; $Hg(CN)_2$.)

Mercuric cyanid occurs in the form of colorless, pri crystals, odorless, and of a bitter, metallic taste. It is soluble in water and alcohol. The dose is from $\frac{1}{4\,0}$– (0.0016–0.006 gm.).

Its action, though less irritant, resembles that of t chlorid. It has been used as a substitute for the latter gical practice and also in the hypodermic treatment of sy

### HYDRARGYRI OXIDUM.

(Mercuric Oxid; HgO.)

Mercuric oxid occurs in two forms: Yellow oxid (*Hydrargyri Oxidum Flavum*, U. S. P.) and red oxid (*Hydrargyri Oxidum Rubrum*, U. S. P.). Both are heavy, permanent, insoluble powders, odorless, and of a somewhat metallic taste. The yellow oxid is an impalpable powder; the red oxid is more or less crystalline. They are not used internally.

PREPARATIONS.

Unguentum Hydrargyri Oxidi Flavi, U. S. P. (10 per cent.).
Unguentum Hydrargyri Oxidi Rubri, U. S. P. (10 per cent.).
Oleatum Hydrargyri, U. S. P. (25 per cent. of yellow oxid).

**Therapeutics.**—The oxids of mercury are used externally for their stimulant and alterative effects. In certain *chronic inflammatory diseases of the eye*—phlyctenular conjunctivitis, keratitis, and blepharitis marginalis, an ointment of the yellow oxid is often very useful. In the last affection it is particularly efficacious when applied at night to the margins of the lids in the strength of 1 gr. of the oxid (0.06 gm.) to 1 dr. (4.0 gm.) of vaselin. In *chronic eczema* an ointment containing from 10–20 gr. (0.6–1.3 gm.) to the ounce (30.0 gm.) is sometimes serviceable. In the form of a dusting-powder the oxids of mercury have also been used in *chancroidal* and *syphilitic sores*. In *chronic adenitis* and other *indolent inflammatory indurations* one of the official ointments or the oleate may be employed for its sorbefacient effect.

The red oxid may be used in the same class of cases as the yellow oxid, but it is less satisfactory on account of its crystalline character.

### HYDRARGYRI SUBSULPHAS FLAVUS.

(Yellow Mercuric Sulphate; Turpeth Mineral; $Hg(HgO)_2SO_4$.)

Yellow mercuric sulphate is a lemon-yellow, odorless, and tasteless powder, sparingly soluble in water. The dose is from 2–3 gr. (0.1–0.2 gm.), repeated once.

**Therapeutics.**—This preparation of mercury was formerly much used as an emetic in *croup*, but it has been largely replaced by less poisonous and less irritant drugs.

### HYDRARGYRI SALICYLAS.

(Basic Mercuric Salicylate, $HgC_7H_4O_3$.)

Mercuric salicylate is a white amorphous powder, without odor or taste. It is insoluble in water or alcohol, but readily so in water containing sodium chlorid. It has been especially

recommended for intramuscular administration in *syphilis*, paraffin or almond oil (1 in 10) being used as a vehicle. dose is from $\frac{1}{8}$ to 1 gr. (0.02–0.065 gm.).

℞ Hydrargyri salicylatis, gr. xv (1.0 c.c.);
Petrolati liquidi, ʒiiss (10.0 c.c.). M.
Sig. From 3–10 min. (0.12–0.6 c.c.), intramuscularly, once or every ten days.

### HYDRARGYRI SUCCINIMIDUM.

(Mercuric Succinimid, $HgC_8H_8O_4N_2$.)

Mercuric succinimid is a white crystalline powder, solu 75 parts of cold water and in 300 parts of alcohol. It is paratively non-irritant and does not precipitate albumin. dose, by the mouth, is from $\frac{1}{6}$–$\frac{1}{4}$ gr. (0.01–0.015 gm.).

Mercuric succinimid has been used chiefly by hypod injection in the treatment of *syphilis*, from 8–15 minims (0 c.c.) of a 2.5 per cent. solution being given daily or every day. Recently it has been highly recommended by Wright in *pulmonary tuberculosis*, injections being given other day ($\frac{1}{6}$ gr.–0.013 gm.) for two months and followed course (two weeks) of potassium iodid.

## ICHTHYOL.

(Ammonium Sulpho-ichthyolate.)

Ichthyol is the ammonium salt of ichthyol sulphoni The latter is the product of the action of sulphuric acid oily substance obtained by the destructive distillatio bituminous mineral rich in fossil fish, found in the Tyr is a thick, reddish-brown liquid, having a bituminous od taste. It is soluble in water and in a mixture of alcoh ether, miscible with oils and glycerin in all proportion almost insoluble in strong alcohol or ether. It contains 15 per cent. of sulphur, and to this ingredient its thera properties, no doubt, are largely due. The dose is fron gr. (0.13–0.65 gm.), in capsules or pills.

**Physiologic Action.**—When applied to the skin i centrated form, ichthyol produces slight redness and b Its absorption through the unbroken skin is readily e if gentle friction be used in the application. The effic the drug in many inflammatory diseases of the skin ar cous membranes has been attributed to a constricting on the vessels and to an alterative influence on the tissues, especially the glandular cells. Fessler, Abel, N and others have shown, also, that it possesses decided icidal properties. According to Neisser, even in solut

dilute as 1 per cent. it is rapidly destructive to gonococci. Internally, large doses cause eructations, nausea, vomiting, and diarrhea.

**Therapeutics.**—Ichthyol is very largely employed externally as an antiseptic and alterative. In the form of an ointment it is decidedly useful in reducing *inflammatory swelling in glands and joints.* The best vehicle is lanolin, and the strength of the application may vary from 25 to 50 per cent. It is of some value as a local remedy in *erysipelas*, and in this disease it may be combined with blue ointment, as in the following formula, so highly extolled by Roswell Park:

| | | |
|---|---|---|
| ℞ | Ichthyol, | gr. xxx–xl (2.0–2.6 gm.); |
| | Resorcinolis, | ʒss (2.0 gm.); |
| | Unguenti hydrargyri, | ʒiv (15.5 gm.); |
| | Adipis lanæ hydrosi, | ʒv (20.0 gm.).—M. |

It is said to be useful, either as a lotion or an ointment (10 to 20 per cent.), in certain diseases of the skin, especially *acne, vesicular and squamous eczema, pruritus*, and *urticaria.* It is sometimes of service in *bruises, sprains*, and *chilblains.* Tampons saturated with ichthyol and glycerin (1 to 20 or 1 to 10) are sometimes remarkably beneficial in *oöphoritis, perimetritis, endometritis, cervical catarrh*, and *gonorrheal vaginitis.* In *atrophic rhinitis* no remedy is so efficacious as ichthyol in relieving the disagreeable symptoms. After the nares have been thoroughly cleansed, pledgets of cotton soaked in an aqueous solution (20 to 50 per cent.) should be inserted and allowed to remain for a period of from fifteen to twenty minutes, or in bad cases the drug may be applied pure by means of a probe armed with cotton.

The chief drawback to the use of ichthyol externally is its unpleasant, bituminous odor; this can be disguised in a measure by the addition of oil of bergamot (1 : 40).

Ichthyol has been used internally in a variety of diseases, particularly *tuberculosis* and *rheumatism*, but the testimony to its efficacy is not convincing.

**Incompatibles.**—Acids, alkalis, and alkaloidal salts.

**Ichthalbin.**—This preparation is a combination of ichthyol and albumin, appearing as a brownish powder, odorless, and nearly tasteless. The dose is from 5–10 gr. (0.33–0.65 gm.). It has been thoroughly exploited as a substitute for ichthyol, both for internal and external use.

**Ichthoform** is a condensation product of ichthyol and formaldehyd. It has been recommended as a substitute for iodoform; but notwithstanding its freedom from odor it is less satisfactory than the older remedy.

**Ichthargan** is a compound of ichthyol and silver, contain-

ing 30 per cent. of metallic silver in organic chemical c
nation. It is a brown, amorphous powder, with a faint
of chocolate. It is freely soluble in water, diluted al
and glycerin. It has been used with asserted good res
*gonorrhea*, injections of a 1 : 10,000 to a 1 : 1000 so
being made three or four times daily.

**Thiol.**—This is a synthetic product obtained by the
of sulphur and sulphuric acid upon hydrocarbon as form
the destructive distillation of peat. It was introduce
substitute for ichthyol, but it has not proved a very fo
ble rival.

## AURI ET SODII CHLORIDUM, U. S. I

(Gold and Sodium Chlorid; $AuCl_3 + NaCl$.)

The gold and sodium chlorid of the Pharmacopeia is
ture of equal parts, by weight, of dry gold chlorid and s
chlorid. It is an orange-yellow powder, slightly deliqu
of a saline and metallic taste. It is freely soluble in
The dose is from $\frac{1}{20}$–$\frac{1}{4}$ gr. (0.003–0.016 gm.), in pill.

**Physiologic Action and Therapeutics.**—Gol
sodium chlorid is supposed to act as an alterative and a
Large doses have an irritant action and excite gastro-er
It has been recommended in a number of diseases, esp
in *diabetes*, *hysteria*, *neurasthenia*, *tertiary syphilis*, *chron*
*holism*, and *sclerosis of the spinal cord*, but it is of very
ful value.

## COLCHICUM.

(Meadow Saffron.)

Colchicum is the corm and seed of *Colchicum autum*
bulbous perennial growing in Southern Europe and N
Africa. The corm is official as *Colchici cormus*, and the
*Colchici semen*. The active principle of the drug is th
loid, *colchicin* (*Colchicina*, U. S. P.), which is a whitish
phous or crystalline powder, of a saffron odor and bitte
and is readily soluble in water and alcohol. The d
colchicin is from $\frac{1}{150}$–$\frac{1}{80}$ gr. (0.0004–0.002 gm.).

| Preparations. | Dose. |
|---|---|
| Extractum Colchici Cormi, U. S. P. . . . . | ½–2 gr. (0.03–0.13 |
| Fluidextractum Colchici Seminis, U. S. P. . . | 2–5 min. (0.1–0.3 |
| Tinctura Colchici Seminis, U. S. P. . . . . | 10–30 min. (0.6–2.0 |
| Vinum Colchici Seminis, U. S. P. . . . . | 10–30 min. (0.6–2.0 |

**Physiologic Action.**—In warm-blooded animal
doses of colchicum or of its alkaloid excite severe ab
pains, nausea, vomiting, and diarrhea. The discharge
first serous, but later they may become mucous an

bloody. These symptoms are followed by progressive motor paralysis, enfeeblement of the circulation, collapse, and finally by death from asphyxia.

Postmortem examination usually reveals pronounced inflammatory lesions in the alimentary canal. In some instances, however, no morbid changes have been observed. Fatal poisoning has occurred from the ingestion of less than 3 dr. (11.0 c.c.) of the wine of the root (U. S. P. 1890), and of less than ½ gr. (0.03 gm.) of colchicin.

The gastro-intestinal features of the poisoning are probably due to the direct irritant action of the drug, although Jacobj attributes them to increased irritability of the motor nerves of the bowel, in consequence of which the muscular coat responds too vigorously to the ordinary stimuli. The paralysis, according to Rossbach, results from depression of the central nervous system. Upon the circulation colchicum appears to have no direct influence. Both the water and the solids of the urine are somewhat increased after moderate doses of the drug, but large doses may be followed by suppression.

**Treatment of Poisoning.**—The stomach should be evacuated as speedily as possible. Albumin and other demulcents are useful in allaying irritation and in preventing further injury to the mucous membrane. Tannic acid is of no value as an antidote. Morphin may be given hypodermically to relieve pain and to inhibit peristalsis. The usual measures will be required to combat the collapse.

**Therapeutics.**—The only disease in which colchicum is of value is *gout*. The good and bad effects of the drug in chronic joint affections seem to have been known as early as the sixth century of the Christian era. For many years it was neglected by regular practitioners, although it still served as the basis of many celebrated nostrums. Later the studies of Halford, Watson, and Garrod reestablished it in the confidence of the profession. The way in which gouty inflammation is affected by colchicum is not understood, and cannot be, until our knowledge of the pathology of the disease becomes more complete. The drug is most potent in acute gout, the pain and swelling of which it relieves as if by magic; it is less efficacious in the chronic manifestations of the disease. In the different forms of rheumatism it is useless.

**Administration.**—As colchicum is powerful for harm as well as for good, considerable care should be exercised in its administration. Only small doses should be employed, and these should be withdrawn or considerably reduced so soon as the pain has been relieved. Large doses, even if they do

not excite irritation of the stomach or purging, may, b
pressing the local manifestations too abruptly, cause the
visceral disturbances to which the term retrocedent go
been applied. The wine and the tincture are reliable pr
tions; they should be taken, well diluted, after food. A
are useful adjuvants, and may be combined with the colc
as in the following formula:

℞ Potassii bicarbonatis, ʒij (8.0 gm.);
Vini colchici seminis, f ʒiiss (10.0 c.c.);
Aqua menthæ piperitæ, q. s. ad f ʒiv (120.0 c.c.).—M.
Sig. A tablespoonful in a wineglassful of water thrice daily,
meals.

Colchicin is a convenient form for administering in p
capsules.

## GUAIACUM, U. S. P.

(Guaiac.)

Guaiac is the resin of *Guaiacum officinale* (Lignum V
large tree growing in the West Indies and South Amer
appears as irregular masses, of a reddish-brown color, t
greenish-brown on exposure, and has an aromatic od
an acrid taste. It is soluble in alcohol and in alkaline
but is insoluble in water. Alcoholic solutions turn b
the addition of oxidizing agents. It contains several r
acids and aromatic oils and gums. The dose is from 5
(0.3–2.0 gm.).

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Guaiaci, U. S. P. (20 per cent. of the resin) | ½–1 fl. dr. (2.0–4.0 c. |
| Tinctura Guaiaci Ammoniata, U. S. P. (20 per cent. of the resin in aromatic spirit of ammonia) | ½–1 fl. dr. (2.0–4.0 c. |

**Therapeutics.**—Guaiac possesses considerable
though less than colchicum, in relieving *gouty inflam*
It is especially efficacious in the subacute and chronic
of the disease. In acute gout it may be substituted
tageously for colchicum so soon as the pain has su
According to Garrod, when it is taken in the inter
gouty attacks it is very effective in averting their recu
The drug is quite innocuous, and may be taken for in
periods without inducing untoward effects. It is also
*tonsillitis* and *chronic rheumatism*.

**Administration.**—The tinctures are reliable prepa
but as they have a very disagreeable taste, they sh
given in the form of an emulsion. The resin itself
given in cachets or in an emulsion.

℞ Guaiaci, ℥iiss (10.0 gm.);
Acaciæ, q. s.
Syrupi, f℥iv (15.0 c.c.);
Aquæ cinnamomi, q. s. ad f℥iv (120.0 c.c.).
Misce et fiat emulsum.
Sig. A dessertspoonful in water after meals.

**Incompatibles.**—Mineral acids and spirit of nitrous ether. Water is incompatible with the tinctures.

## SARSAPARILLA, U. S. P.

Sarsaparilla is the root of *Smilax medica* and of other species of *Smilax*, large perennial climbers growing in swampy places in tropical America. It contains a volatile oil, resin, and several saponins.

| Preparations. | Dose. |
|---|---|
| Fluidextractum Sarsaparillæ, U. S. P. . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Sarsaparillæ Compositum, U. S. P. (sarsaparilla, 75 parts; glycyrrhiza, 12 parts; sassafras, 10 parts; mezereum, 3 parts; glycerin, 10 parts; diluted alcohol to make 100 parts) . . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Syrupus Sarsaparillæ Compositus, U. S. P. (fl. ext. sarsaparilla, 20 parts; fl. ext. glycyrrhiza, 1.5 parts; fl. ext. senna, 1.5 parts; sugar, 65 parts; oil of sassafras, oil of gaultheria, and oil of anise, of each, 0.02 part; water to make 100 parts) . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |

**Therapeutics.**—The action of sarsaparilla is very feeble. It has been used as an alterative in *syphilis* and *tuberculosis*, but it is without value. It is chiefly useful as a vehicle to disguise the taste of unpalatable drugs, particularly potassium iodid.

## JAMBUL.

(Java Plum.)

Jambul is the root and seeds of *Eugenia jambolana*, a large tree growing in the East Indies. The active constituent of the drug has not been determined. The seeds are more powerful than the root, and may be given powdered in doses of from 5–20 gr. (0.3–1.3 gm.), in capsules.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Jambul . . . . . | 10–30 min. (0.6–2.0 c.c.). |

**Therapeutics.**—Jambul has been used solely as a remedy in *diabetes mellitus*, for which it was originally recommended by Banatvala, of Madras. Binz found that it materially lessened the excretion of sugar in phloridzin diabetes, but Minkowski found it absolutely useless in experimental pancreatic

diabetes. Clinically, we have derived some benefit from a few cases of a mild type. Large doses sometimes lesse glycosuria, but increase the quantity of urine. Von den, in a study of 600 cases of diabetes, concludes that jambul has no very marked action on the elimination of it is a good adjuvant to dietetic and hygienic procedures

## MEZEREUM, U. S. P.

(Mezereon.)

Mezereum is the bark of *Daphne Mezereum* and of species of *Daphne*, small shrubs growing in mountainou tricts in Europe and Asia. It contains a bitter glucosi an irritant volatile oil.

PREPARATIONS.

**Fluidextractum Mezerei, U. S. P.**
**Fluidextractum Sarsaparillæ Compositum, U. S. P.** (3 per cent. mezereum).

**Therapeutics.**—Mezereum is an active irritant, and applied to the skin it causes vesication. Large doses fluid extract taken internally produce severe abdomina followed by vomiting and purging. It has been recomm as an alterative in *chronic rheumatism, syphilis*, and *varic diseases*, but its utility has never been satisfactorily d strated. Except in the form of the compound, fluid ext sarsaparilla is never prescribed internally. Externa fluid extract has been used as an irritant application fo *lent ulcers.*

## CALX SULPHURATA, U. S. P.

(Sulphurated Lime; Crude Calcium Sulphid.)

Sulphurated lime is a mixture containing at least cent. of calcium monosulphid, together with calcium s and varying proportions of carbon. It is a pale gray p having a nauseous, alkaline taste and a faint odor of hy sulphid. It is slightly soluble in water and insoluble hol. On exposure to air it is gradually decomposed dose is from $\frac{1}{10}$–$\frac{1}{2}$ gr. (0.006–0.03 gm.), in pills, capsu powders.

**Therapeutics.**—As was first pointed out by Ring phurated lime possesses some power of preventing and ing suppuration. It has been found especially useful in *lar acne*, *boils*, and *carbuncles*. In *follicular tonsillitis quinsy*, doses of $\frac{1}{20}$ gr. (0.003 gm.) every hour sometim excellent results. It is better to give small doses at s tervals than large doses infrequently, since the latter a prone to derange digestion and to cause disagreeable

tions of sulphureted hydrogen. As the drug deteriorates on keeping, only fresh preparations should be used.

As a local remedy, in the form of Vleminckx's solution, it is often very efficacious in *acne rosacea*.

℞ Calcis, ℥ss (15.5 gm.);
Sulphuris sublimati, ℥j (31.1 gm.);
Aquæ, f℥x (296.0 c.c.).
Coque ad f℥vj (177.5 c.c.), deinde filtra.
Sig. Dilute with 10 parts of water and apply to the affected parts.

## URANII NITRAS.

(Uranium Nitrate; Uranyl Nitrate; $UO_2(NO_3)_2 + 6H_2O$.)

Uranium nitrate occurs as light-yellow, rhombic prisms, soluble in water, alcohol, and ether. The dose is ½ gr. (0.03 gm.), gradually increased to 5 gr. (0.3 gm.) or more, freely diluted with water, after meals.

**Therapeutics.**—In large doses uranium salts act as irritant poisons, producing gastro-enteritis and nephritis. Moreover, they affect the oxyhemoglobin of the blood in such a way that its oxygenating power is much reduced. This action on the blood may be responsible for the glycosuria, which, according to Leconte, results from the prolonged use of uranium compounds.

West, Morrison, Duncan, and others have observed improvement in cases of *diabetes mellitus* from the use of uranium nitrate in doses of from 5–20 gr. (0.3–1.3 gm.) two or three times a day. In general, however, the drug has proved disappointing. It certainly has no specific influence on the disease, and whatever action it may have in lessening the excretion of sugar probably depends, as Symonds suggests, on its effect in retarding the digestion of starches.

## GLANDULÆ THYROIDEÆ SICCÆ, U. S. P.

(Desiccated Thyroid Glands; Thyroid Extract.)

The profession is largely indebted to the observations of Kocher and to the experimental researches of Horsley for the treatment of myxedema and allied conditions by the administration of thyroid gland. Kocher found that complete removal of the thyroid gland was followed in many instances by the appearance of a peculiar cachexia, the symptoms of which were almost identical with those of myxedema. Horsley showed that thyroidectomy in monkeys induced a similar condition. Schiff proved that the bad effects of thyroidectomy in animals could be averted by transplanting the gland in the peritoneum or subcutaneous tissue, and thereupon Horsley

suggested this treatment for myxedematous conditio
man. Murray, in 1891, found that transplantation c
gland was unnecessary, as the same results could be se
from hypodermic injections of thyroid juice, and a little
Mackenzie demonstrated that thyroid feeding was e
efficacious.

According to Baumann, the active constituent of the th
gland is *iodothyrin*, a non-proteid compound containing
5 to 10 per cent. of iodin. This substance is localized
colloid matter, and is probably secreted by the gland in
ciation with an iodin proteid, the two forming the *thyreo*
*lin* of Oswald.

**Physiologic Action.**—Large doses of thyroid e
frequently, but not invariably, produce a train of sympto
which the term *thyroidism* has been applied. The most
mon manifestations of this intoxication are restlessne
somnia, headache, palpitation of the heart, weakness
circulation, anorexia, nausea, elevation of temperatur
perspiration, shortness of breath, tremors and twitchir
the limbs, prostration, and progressive loss of flesh.
be observed that these symptoms are not unlike those
ophthalmic goiter, and to make the resemblance more
plete, swelling of the thyroid gland and exophthalmo
occurred in a few instances. Coppez has reported 5 ca
optic neuritis from the continued use of large doses.

In man, the most constant effect of thyroid extract in r
nal doses is increased oxidation, in consequence of w
considerable reduction in the body-weight occurs. Bo
proteids and the fats suffer disintegration, but, accord
Vendelstadt, only one-sixth of the loss of weight can be
uted to the destruction of nitrogenous compounds, th
being due to oxidation of fats and to increased excre
water. The excessive catabolism of proteids is made
by the increased excretion in the urine of nitrogen and o
phorus; the more rapid combustion of fats, by the inc
elimination of carbon dioxid and the greater dema
oxygen.

In excess, thyroid extract frequently increases the
the pulse and lowers the arterial pressure. The ma
which these effects on the circulation are produced
known. The hurried respiration observed in thyroidis
be due to the increased demand for oxygen. Even i
erate doses the drug usually increases the quantity of
and in large doses it may induce albuminuria and glyc

**Elimination.**—Iodothyrin must be decomposed
body, at least to some extent, since after its adminis
iodin appears in the urine. Hutchinson found this e

in the urine of a dog three hours after the administration of 15 gr. (1 gm.) of colloid matter. That a part of the active constituent resists destruction in the body and escapes through avenues other than the kidneys is evidenced by the fact that an infant may acquire thyroidism through the mother's milk.

**Therapeutics.**—The diseases in which thyroid extract is most efficacious are *cretinism* and *myxedema of the adult.* In cretinism the results are often truly remarkable, especially when the treatment is instituted early. "Within six weeks," as Osler writes, "a poor, feeble-minded, toad-like caricature of humanity may be restored to mental and bodily health." In both affections the remedy must be continued throughout life, otherwise relapses occur. After the symptoms have been relieved, a weekly or biweekly dose may be all that is necessary to maintain normal metabolism. Thyroid extract sometimes proves efficacious, also, in *infantilism*, and in certain other conditions on the borderland of myxedema, in which imperfect mental and physical development is a prominent feature.

Considerable success has attended the use of the drug in *simple goiter*, especially in that form met with in adolescents. No effect, of course, can be expected from the treatment in the old cystic goiters of adults. In exophthalmic goiter thyroid feeding is either useless or harmful.

The loss of flesh following the administration of thyroid extract suggested its use in *obesity*. Ebstein believes that the treatment is not a rational one, since the drug causes a waste of the body-proteids as well as of the fats. The nitrogen loss can be controlled in a measure, however, by increasing the amount of proteids in the food, so that it does not become an insurmountable objection to the treatment. In some cases of obesity the remedy proves entirely satisfactory and is not followed by any unpleasant consequences. It is most effective in the cases which bear a certain resemblance to myxedema, in which the skin is pale and the tissues are soft and flabby. Unfortunately, many patients rapidly acquire a tolerance for the drug, and for this reason relapses are common.

In certain skin diseases, such as *psoriasis* and *ichthyosis*, thyroid extract is occasionally serviceable, but in the majority of cases it proves disappointing. In *inoperable cancer* it is often useful as a palliative remedy in relieving pain, dispelling disagreeable odor, and retarding ulceration. The drug seems to have a special influence on the uterus. There is considerable testimony as to its efficacy in *metrorrhagia* from various causes, and some authorities go so far as to claim for it the power of reducing the size of *uterine fibroids.* Montgomery has found it useful in *sterility* dependent upon obesity.

The hope that thyroid extract might prove valuable in tain forms of insanity has not been realized. While observers, notably Mabon and Babcock and Easterbrook, found it useful in acute melancholia, acute mania, puer and climacteric insanities, and stuporous states, the testi of most alienists has been unfavorable.

**Administration.**—As persons vary considerably in susceptibility to thyroid preparations, it is always advisa begin with small doses and gradually to increase them. rule, it is better to give small doses frequently than doses at long intervals. Treatment should be suspend least temporarily, on the very first appearance of unt symptoms. Mabille and Ewald have shown that the d much better received when combined with small dos arsenic. Individuals with tuberculosis, Bright's disease cardiac insufficiency are generally intolerant to thyroid cation.

Thyroid gland may be given in the form of the fresh of the sheep, the dried glands (Glandulæ Thyroideæ S the glycerin extract (Liquor Thyroidei, B. P.), or iodot The fresh glands may be given raw or slightly cooked in of from $\frac{1}{8}$–$\frac{1}{2}$ of a gland a day. The dried glands an glycerin extract, however, are far more convenient an just as potent. Dry thyroid is a light, dull-brown po with a meat-like odor and taste. On exposure to a moisture it is liable to decompose. The dose is from 1 (0.06–0.3 gm.) three times a day. The glycerin extra pinkish turbid fluid, without putrescent odor. One hu min. (6.0 c.c.) equal one fresh gland. The dose is from min. (0.3–1.0 c.c.). Tablets of iodothyrin triturated with sugar are on the market, and may be given in doses of 2–10 gr. (0.13–0.6 gm.) thrice daily.

## GLANDULA THYMUS.

(Thymus Gland.)

The persistence of the thymus in the majority of ca exophthalmic goiter suggested the possibility of an antag between this gland and the thyroid. Reasoning from th mise, many have employed thymus preparations in the ment of *Graves's disease*. Kinnicutt, in 1897, collected 62 treated with the gland. Of these, 36 cases showed im ment; 25 were unimproved or showed aggravation symptoms. Of 20 cases treated by Mackenzie, 1 died, i improvement was observed, and in 13 there was some im ment. In none of the cases, however, was the effect

cided as to justify the conclusion that the thymus has any great therapeutic activity. Mendel, Mettenheimer, and others claim to have had good results from the use of thymus preparations in *rickets*. They base the treatment on Friedleben's observation that the thymus gland is often atrophied in rachitic children, and on Mendel's observation that removal of the thymus in dogs induces symptoms resembling rachitis. The dose of the dried gland is from 10–15 gr. (0.6–1.0 gm.) or more three or four times a day.

## HYPOPHYSIS CEREBRI.

(Pituitary Body.)

Schaefer and Vincent have demonstrated the existence of two substances in the infundibular part of the pituitary body, one producing a rise and the other a fall of blood-pressure. They distinguish them as the pressor and depressor substances respectively, the former being insoluble in alcohol and ether, while the latter is soluble in both of these fluids. The pressor substance, the more active of the two, when given hypodermically, stimulates the heart and constricts the arterioles, in consequence of which it raises the blood-pressure, slows the pulse, and increases the quantity of urine.

The almost constant finding of lesions of the hypophysis in *acromegaly* suggested the use of pituitary extract in the treatment of this disease. Of 20 cases so treated collected by Hinsdale, 9 showed some improvement in the subjective symptoms. The dose of the dried extract is from 3–5 gr. (0.2–0.3 gm.) three times a day.

## TESTIS AND OVARIUM.

In 1889 Brown-Séquard announced that he had personally experienced remarkable rejuvenating effects from injections of the extract of the testicle of rabbits. Emanating from such a high authority, this announcement led rapidly to the use of orchitic extracts, not only in senility, but in impotence, neurasthenia, hysteria, locomotor ataxia, and many other affections of the nervous system. More or less favorable results of this treatment have been reported, but in no instance has the good achieved been so decided as to convince a judicious observer that it was not due to mental suggestion rather than to the physiologic activity of the drug itself. So few have been convinced of the efficacy of the remedy that it has already been practically abandoned.

Upon the assumption that the ovary is a secreting gland, its substance has been recommended in a variety of conditions connected with menstruation, especially for the relief of the

distressing symptoms attending the premature or artificial n
pause. The results of its use, however, have not been
satisfactory; moreover, there is no good reason for beli
that the ovary has any other function than that of ovula

## ANTIPYRETICS OR FEBRIFUGES.

The body derives its heat mainly from the oxidation of
stuffs and from various mechanical movements, and lo
mainly by radiation and conduction from the skin and l
evaporation of water from the skin and lungs. Nor
heat-production and heat-dissipation are so evenly bal
that a mean temperature of 98.6° F. in the axilla is maint
notwithstanding considerable variations in the surrou
temperature. The balance between income and exper
is secured through the operation of a regulating mech
located in the central nervous system.

Antipyretics are drugs that lower temperature whe
abnormally high. They exert but little influence up
normal temperature. Some of them, like *acetanilid*,
*cetin*, and *antipyrin*, act directly on the heat-regulating
in such a way that the standard of temperature is broug
lower level, where it is maintained for a limited period;
like *alcohol*, through their influence on the circulation, i
the dissipation of heat; while others, like *quinin*, less
production of heat by retarding oxidation.

*Diaphoretics* lower temperature by increasing the
heat due to the evaporation of sweat.

*Cold applications* increase the heat-loss by conductio

**Indication.**—Antipyretics are employed to lower t
ature in febrile states. They are indicated, howeve
when the temperature is sufficiently high as to be in
source of actual danger or of considerable discomfort
patient. When used repeatedly at short intervals, they
more or less depressing. On the other hand, cold
has a stimulant as well as an antipyretic effect, and
reason, when it can be carried out satisfactorily, it is
preferable to the use of drugs.

The most important antipyretics are:

Acetanilid,
Antipyrin,
Phenacetin,
Phenocoll,
} Coal-tar antipyretics.

Quinin.
Guaiacol
Aconite.

*Salicylic acid*, *carbolic acid*, and *resorcin* also lower temperature in febrile states, but they are no longer used for this purpose.

## ACETANILIDUM, U. S. P.

(Acetanilid; Antifebrin; $C_6H_5NH.C_2H_3O$.)

Acetanilid is a derivative of anilin, an atom of hydrogen in the latter being replaced by the acetic acid radical acetyl. It is a white, shining, crystalline powder, odorless, and of a faintly burning taste. It is soluble in 179 parts of water, in 2.5 parts of alcohol, and in 12 parts of ether. The dose is from 3–10 gr. (0.2–0.65 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Pulvis Acetanilidi Compositus, U. S. P. (acetanilid, 70 parts; caffein, 10 parts and sodium bicarbonate, 20 parts) . . . . . | 5–15 gr. (0.3–1.0 gm.). |

**Physiologic Action.**—In health, single, moderate doses (5–10 gr.—0.3–0.65 gm.) of acetanilid produce no perceptible effect. In fever, however, they induce a marked fall in temperature, which usually begins within two or three hours, and lasts a variable time, generally four or five hours. The fall in temperature is often associated with free perspiration. The antipyretic action of the drug has not been satisfactorily explained, but it appears to be the result of a direct influence exerted on the heat-regulating centers, in consequence of which the cutaneous vessels are dilated and the heat-dissipation is increased.

**Circulation.**—In ordinary doses acetanilid has no pronounced action on the circulation, a slight quickening of the pulse, however, is sometimes observed, which is probably the result of the direct action of the drug on the cardiac muscle.

**Blood.**—After large doses the blood becomes of a chocolate color, owing to the production of methemoglobin. The corpuscles themselves, however, do not suffer disintegration unless the dose has been very large.

**Respiration.**—The drug seems to have no direct action on respiration. In poisoning there is marked dyspnea, but this is probably due to the changes induced in the red blood-cells.

**Nervous System.**—Our knowledge of the action of acetanilid on the nervous system is very vague. The fact that the drug relieves headache and neuralgic pain without affecting

movement or consciousness shows that it has a special af for the sensory neurons, but as in large doses it induces or less somnolence and paresis, it must affect also, thougl less extent, other portions of the nervous apparatus tha sensorium. Locally, on mucous membranes and raw su it exerts an analgesic effect by depressing the peripheral sory nerves. Bokai and others assert that in frogs it lyzes the motor nerve-endings also when directly applied

In animals, poisonous doses may excite convulsions these appear to be sometimes of spinal and sometimes of bral origin.

**Metabolism.**—The testimony as to the action of acet upon nitrogenous elimination is so contradictory as to j the conclusion that the drug has but little influence on or the other upon tissue-metabolism.

**Absorption and Elimination.**—Acetanilid is absorbe eliminated with great rapidity. It is largely oxidized i organism, and appears in the urine as the sulphate and uronate of paramidophenol.

**Action on Lower Organisms.**—It has some power hibiting the growth of bacteria, but its germicidal powe feeble.

**Toxicology.**—The chief symptoms of acetanilid pois are marked cyanosis, feeble breathing, extreme weakn the circulation, free perspiration, dilatation of the pupil collapse. *Treatment* consists in maintaining the tempe of the body by means of external heat and in supporti respiration and circulation by the liberal use of such dr strychnin, ammonia, and atropin. Artificial respiratio oxygen inhalations are useful in combatting the cyanosi

**Untoward Effects.**—Idiosyncrasies to acetanilid a uncommon. Some persons are so susceptible to its that cyanosis and collapse follow the administration drug even in small doses. Summers has reported an in in which 4 grains, repeated in thirty minutes, caused cy partial loss of consciousness, and grave collapse in a h patient, who had many times previously taken the d much larger doses without ill effects.

Fortunately, in the vast majority of such cases re follows under appropriate treatment. Papular and ery tous rashes are occasionally induced by acetanilid, but frequently as by antipyrin.

**Therapeutics.**—Moderate doses of acetanilid (5 g gm.) are sometimes useful in controlling the tempera

such diseases as *typhoid fever*, *scarlet fever*, and *erysipelas*. Nothing, however, is to be gained from the use of antipyretic drugs in these diseases when the temperature is not above 103° F. or 103.5° F., and is not causing much inconvenience to the patient. They should be employed only when the temperature itself is exciting considerable discomfort or when it is so high as to exert a baleful influence upon the nutrition of the vital organs; even then, hydrotherapy, on account of its stimulant effects, is always preferable if it can be satisfactorily carried out and is not precluded by some special feature of the case.

In tuberculosis and other adynamic diseases coal-tar antipyretics, if used at all, must be used with the utmost caution.

Acetanilid and its congeners, judiciously employed, are of great value in relieving certain forms of pain, particularly *headache*, *neuralgia*, *migraine*, the *pains of influenza*, and even the *nerve-storms of locomotor ataxia*, but they have little or no influence upon the pain of acute inflammation, of traumatism, or of morbid growths.

Acetanilid has been recommended as a depressomotor in *epilepsy*, *chorea*, and *whooping-cough*, but for this purpose it has been employed much less extensively than antipyrin.

Externally, it has been frequently substituted for iodoform in the treatment of *wounds*, *burns*, *ulcers*, and *chancroidal sores*. Its advantages are its inexpensiveness and freedom from odor. It must be employed with some caution, as it may be absorbed in sufficient quantity to produce toxic symptoms. This use of the drug appears to be decidedly dangerous in young children, no less than 20 cases of poisoning from it in infants having been reported within recent years.

**Administration.**—It may be administered in powders, capsules, tablets, or pills. When a prompt effect is desired, it should be given in solution, alcohol being used as a solvent before the diluent is added.

**Incompatibles.**—With alkaline bromids and iodids, in aqueous solution, it forms insoluble compounds. When triturated with antipyrin, chloral, thymol, or resorcin, it forms a semiliquid mass. When added to spirit of nitrous ether, the solution after a time turns yellow and then red.

**Exalgin** or **methyl-acetanilid** is also a derivative of anilin. It has no advantages over acetanilid, which it resembles very closely in its action. It has been used more as an analgesic than as an antipyretic. The dose is from 3–10 gr. (0.2–0.6 gm.).

## ANTIPYRINA, U. S. P.

(Antipyrin; Phenazon; Phenyl-dimethyl-pyrazolon; $C_6H_5(CH_3)_2C_3HN_2O$

Antipyrin is a synthetic base obtained by acting on phe hydrazin (an anilin derivative) with diacetic ether, and t methylating the resulting monoethyl compound. It oc in white, crystalline scales, odorless, and of a somewhat b taste. It is freely soluble in water, alcohol, and chlorof The dose is from 3–15 gr. (0.2–1.0 gm.).

**Physiologic Action.**—The action of antipyrin, so fa it is definitely known, closely resembles that of acetanilid. probably a little less toxic than acetanilid, although it is r prone than the latter to cause papular or erythematous eruptions. It is absorbed and eliminated very rapidly, a of it escaping undecomposed through the kidneys.

**Therapeutics.**—Antipyrin is employed internally fo same purposes as acetanilid. Both are used to *lower tem ature in fever* and to *relieve pains of a neuralgic char* While the two drugs are equally efficacious, one somet succeeds where the other fails.

Antipyrin has been used to a considerable extent a antispasmodic. The diseases in which it is has acquire most reputation in this respect are *epilepsy* and *whoo cough.*

In epilepsy it sometimes renders excellent service a adjuvant to the bromids. From 10–15 gr. (0.6–1.0 gm.) may be given for three or four weeks, and then disconti for two or three weeks before being resumed. The should be withdrawn at once, however, if cyanosis ap In whooping-cough no remedy is so generally useful in trolling the paroxysms as antipyrin. It may be give itself or in combination with a bromid, as in the follo formula:

℞ Antipyrinæ, gr. l (3.2 gm.);
Sodii bromidi, ʒiss (6.0 gm.);
Glycerini, fʒss (15.0 c.c.);
Aquæ menthæ piperitæ, q. s. ad fʒiij (90.0 c.c.). M.
Sig. A teaspoonful in water every three hours for a child o years.

Antipyrin is of some value in *diabetes mellitus*, bu manner of its action is unknown. Locally it has been re mended as an analgesic and as a hemostatic. As an ana it has been used with more or less success in relievin pain of *cancerous ulcers.* Deep injections of a 50 per solution have been employed also in *lumbago* and in *sc*

but they are painful and liable to cause abscesses. As a hemostatic it sometimes is effective in arresting hemorrhage from small vessels; thus solutions of from 5 to 10 per cent. have been found satisfactory in checking *epistaxis* and in controlling the *capillary oozing after operations.* In some persons its application in any strength proves irritating.

**Administration.**—Antipyrin may be given by the mouth in the form of powders or capsules, but on account of its ready solubility it is perhaps best ordered in some aromatic water. In exceptional cases it may be administered hypodermically or by the rectum.

**Incompatibles.**—On account of its basic properties antipyrin has a wide range of incompatibility. It is incompatible with iron salts, calomel, corrosive sublimate, iodin, iodids, benzoates, carbolic acid, ammonia water, sodium bicarbonate, nitrites, and all preparations containing tannic acid. When triturated with chloral, butyl-chloral, sodium salicylate, orthoform, or beta-naphthol, it forms a semiliquid mass. When added to spirit of nitrous ether a green color results from the formation of iso-nitroso-antipyrin.

## ACETPHENETIDINUM, U. S. P.

(Acetphenetidin; Phenacetin; $C_6H_4.OC_2H_5.NHC_2H_3O$.)

Acetphenetidin, or phenacetin, is obtained by acting on paraphenetidin (an anilin derivative) with glacial acetic acid. In the reaction that takes place an atom of hydrogen in paraphenetidin is replaced by the acetic acid radicle, acetyl. It forms colorless, tasteless, inodorous scales, soluble in alcohol and in glycerin, but only sparingly so in cold water. The dose is from 5–10 gr. (0.3–0.65 gm.).

**Physiologic Action and Therapeutics.**—The studies that have been made upon the action of phenacetin indicate that it exerts much the same influence as acetanilid and antipyrin, save that it is less toxic than either of these drugs. On the whole, it is the most satisfactory of the coal-tar antipyretics, and when used in moderate doses, it is rarely followed by cyanosis, collapse, cutaneous eruptions, or other untoward effects. It may be employed with advantage as an antipyretic and analgesic in the same class of cases as that in which acetanilid has been found to be useful.

**Administration.**—It may be given in pills, capsules, powders, or tablets.

**Incompatibles.**—Salicylic acid, iodin, carbolic acid, ch
hydrate, and oxidizing agents.

**Lactophenin.**—This compound is closely allied to ph
etin in that it is para-phenetidin with an atom of hydr
replaced by the lactic acid radicle, lactyl, instead of b
acetic acid radicle, acetyl. In addition to being an antip
and analgesic it has some power as a somnifacient. The
is from 5–15 gr. (0.3–1.0 gm.).

**Phenocoll Hydrochlorid.**—This phenetidin deriv
represents an attempt to produce a soluble phenacetin. C
ically, it is glycocoll para-phenetidin hydrochlorid. It
white, crystalline powder, soluble in about 16 parts of
It is readily decomposed by alkalis and alkaline carbo
The dose is from 5–15 gr. (0.3–1.0 gm.). As an antip
and analgesic it appears to be a safe and an effective subs
for acetanilid and antipyrin. It has been used also in *rh
tism* and in *malarial fever*, but with very indifferent succ

**Apolysin, Citrophen, and Kryofin.**—These compo
all phenetidin derivatives, have been introduced as riv
phenacetin. Apolysin differs from phenacetin in cont
a citric acid radicle instead of an acetic acid radicle. Citr
differs from apolysin in containing 3 phenetidin groups i
of 1 to the molecule of citric acid. Kryofin differs from pl
etin in containing a methyl-glycollic acid radicle inste
an acetic acid radicle. The dose of any one of these
pounds is from 5–15 gr. (0.3–1.0 gm.).

## OTHER ANTIPYRETICS.

**Quinin** (see p. 416).—In health the bodily temperat
not appreciably lowered by quinin unless the dose be
sive, but in febrile states the drug usually exerts a n
antipyretic influence when given in doses of from 20 to
(1.3–2.0 gm.). This effect on the temperature cann
attributed to an action on the heat-regulating centers, s
occurs after section of the spinal cord; it appears to b
rather to an interference with metabolism, in conseque
which there is a decrease in the production of heat.

The best results are obtained by giving the drug
large dose a few hours before a natural remission is ex
to occur. As a matter of fact, however, quinin is rarel
as an antipyretic at the present time. When it is d
necessary to lower the temperature by means of dru
coal-tar derivatives, on account of the certainty and p
ness of their action, the ease with which they can be

istered, and their power to relieve headache and other pains incident to fever, are preferable to quinin, which lacks these advantages, and which, moreover, often disturbs the stomach.

**Guaiacol** (see p. 286).—In febrile diseases guaiacol, applied to the skin, acts as a prompt and powerful antipyretic. To secure the desired effect about 30 min. (2.0 c.c.) should be slowly rubbed into the skin of the abdomen with a camel's-hair brush, and the part subsequently covered with a piece of waxed paper to prevent evaporation. The absorption of the drug, which usually occurs in a few minutes, is followed by a gradual fall of temperature, the lowest point being reached about three hours after the application. The reduction of temperature is associated with profuse perspiration, and is followed shortly by a rapid return of the fever, with marked chilliness. The applications, especially if made repeatedly, often cause considerable depression, and for this reason guaiacol cannot be recommended as an antipyretic, except for occasional use.

**Aconite** (see p. 60).—Compared with the coal-tar derivatives, aconite is but a feeble antipyretic. It lowers temperature probably through a central action, but this has not been definitely established. On account of its sedative influence on the circulation it is a useful febrifuge in *acute inflammatory conditions* and in the *febrile diseases of childhood* when the pulse is rapid and strong. It is contraindicated in asthenic fevers. The best results are obtained by giving the tincture in small doses at frequent intervals. Spirit of nitrous ether and the solution of ammonium acetate are useful synergists.

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## ASTRINGENTS.

Astringents are substances which, by their direct action, cause contraction or condensation of the tissues. Their influence is most marked upon raw surfaces and mucous membranes. Many of them have also the property of diminishing or arresting glandular secretion, and this they accomplish not so much by constricting the blood-vessels of the part as by affecting the secreting cells directly. While their action is probably due in part simply to shrinking of the protoplasm, it is undoubtedly chiefly due to precipitation or to coagulation of the albumin of the cells.

Astringents are divided into two classes, *vegetable* and *mineral*. The former owe their efficacy to the presence of tannic

acid. There are but few astringents that are not also irrit
especially if employed in concentrated form. Some o
metallic salts are more irritant and caustic in their action
they are astringent. This is due in one instance to the ir
properties of the acid liberated by the union of the metal
the albumin of the cells; in another instance to the inte
toxic nature of the metal itself; and in still another instan
the permeable texture of the coagulum that is formed b
first application of the salt.

Among the mineral astringents, the insoluble salts o
muth, zinc oxid, and lead acetate have more of a sedative
an irritant action.

The chief vegetable astringents are:

| | |
|---|---|
| Tannic acid. | Gambir. |
| Gallic acid. | Geranium. |
| Galls. | Hematoxylon. |
| Kino. | Sumac. |
| Krameria. | Oak bark. |

Hamamelis.

The chief mineral astringents are:

| | |
|---|---|
| Alum. | Zinc oxid. |
| Lead acetate. | Silver nitrate. |
| Copper sulphate. | Bismuth subnitrate. |
| Zinc sulphate. | Bismuth subcarbonate. |

Calcium carbonate.

Iron salts (see p. 289) and weak solutions of mineral
especially sulphuric acid (see p. 448), also have an astr
action.

**Indications.**—The very mild astringents, like bi
subnitrate and zinc oxid, are useful as protectives in
superficial inflammations; the more active ones, like the
acid compounds and zinc sulphate, are employed to less
excessive secretion often remaining as a sequel of ac
flammation of mucous membranes. Some astringent
alum and tannic acid, are also used to check hemo
their styptic properties depending upon their power to
late the albumin of the blood.

## ACIDUM TANNICUM, U. S. P.

(Tannic Acid; Tannin; Gallotannic Acid; $HC_{14}H_9O_9$.)

Tannic acid is the active constituent of all the ve
astringents. It is derived from the nutgall, which c

from 30 to 60 per cent. of it. The pure acid is a light-yellowish, amorphous powder, almost odorless, and of a strongly astringent taste. It is soluble in about 0.34 part of water, in 0.23 part of alcohol, and in 1 part of glycerin. The dose is from 3–10 gr. (0.2–0.6 gm.).

PREPARATIONS.

Collodium Stypticum, U. S. P. (20 per cent.).
Glyceritum Acidi Tannici, U. S. P. (20 per cent.).
Unguentum Acidi Tannici, U. S. P. (20 per cent.).
Trochisci Acidi Tannici, U. S. P. (1 gr.—0.06 gm.—in each).

**Physiologic Action.**—When applied to raw surfaces tannic acid precipitates the albumin of the superficial cells and causes condensation of the tissues. At the same time it lessens the sensibility of the peripheral nerves. On mucous membranes it acts in a similar manner, but more decidedly, and in addition dries up secretion by combining with the proteids of the glandular cells. Whether or not it constricts the blood-vessels with which it comes in contact is a mooted question. It coagulates blood, and thus serves as a local styptic. It is said also to inhibit the diapedesis of the leukocytes. When taken internally, the acids of the gastric juice prevent it from forming a permanent union with any proteids that may be present, so that it is free to act as an astringent in both the stomach and bowel. In moderate doses it impairs digestion and causes constipation; in very large doses it acts as an irritant and excites vomiting and diarrhea.

In the intestine, tannic acid is transformed into gallic acid, and in this form a certain amount is absorbed and is subsequently eliminated in the urine.

**Therapeutics.**—Locally, tannic acid is much used to check excessive secretion and to impart tone to relaxed mucous membranes. In *subacute and chronic laryngitis and pharyngitis* a solution of from 1–5 gr. (0.06–0.3 gm.) to the ounce (30.0 c.c.) makes a useful spray. Some surgeons have found injections of the glycerite, more or less diluted, efficacious in *subacute and chronic urethritis.* The same preparation is frequently beneficial in *chronic vaginitis, leukorrhea, erosion of the uterine cervix,* and *chronic cervical endometritis.* Lotions and dusting-powders containing tannin sometimes act favorably in *hyperidrosis of the feet.*

When it can be brought in direct contact with a bleeding surface tannic acid is a reliable hemostatic. In *epistaxis* strips of lint spread with vaselin and tannic acid make an excellent tampon. In *hematemesis* or *enterorrhagia* the drug may be given in full doses by the mouth. As it is absorbed in the form of gallic acid, which has no styptic power, it is valueless

as an internal remedy in hemorrhages outside of the alin ary canal.

As it forms more or less insoluble tannates with *t emetic* and the *vegetable alkaloids*, it may be employed chemical antidote in *poisoning* by one of these drugs. tani and others have spoken highly of enteroclysis with tannic acid solution (2 per cent.) in *Asiatic cholera*.

**Administration.**—When its action is desired in the ach, tannin should be given in powder; if the intestine is reached, it should be given in pill.

**Incompatibles.**—Alkaloids, gelatin, lime-water, emetic, and the salts of iron, silver, lead, and copper. tannic acid is triturated with potassium chlorate the m explodes with great violence; hence, when these two are to be combined in solution, they should be dissolved rately before being brought together.

**Tannalbin, Tannigen, and Tannoform.**—In th few years several attempts have been made to enhan therapeutic value of tannic acid as an intestinal astring converting it into compounds that will pass through the ach unchanged and will be decomposed in the intestin ting free the acid. The most important of these new pounds are tannalbin, tannigen, and tannoform.

**Tannalbin** is a light-brown, odorless and tasteless p containing about 50 per cent. of tannin. It is prepa subjecting tannin albuminate to dry heat for a consid time. The dose for adults is from 15–20 gr. (1.0–1.3 g powders or cachets; for children, from 5–15 gr. (0.3–1.0 in some mucilaginous vehicle or in powders.

**Tannigen** is an acetic ester of tannic acid, and appea yellowish, odorless, almost tasteless, hygroscopic powd soluble in water. As in the case of tannalbin, its ast properties are not manifested until it reaches the bowel, its decomposition is effected. It may be given in th dose as tannalbin.

Experience in the use of these two remedies warra opinion that they may be used interchangeably; that t free from irritant properties, even when administered i amounts; and that they have a definite, if but limited, usefulness in the treatment of *acute intestinal catarrh* chief indication for their employment is the continua profuse and watery discharges after the cause of the mation has been completely removed. In chronic d and in dysentery they usually prove disappointing, tuberculous enteritis, of course, no favorable results fro are to be expected.

**Tannoform** is a combination of tannic acid and formaldehyd. It appears as a pale-pink powder, insoluble in water. It escapes decomposition in the stomach, but in the intestine is slowly broken up, yielding free tannin and formaldehyd. The dose for an adult is from 3–5 gr. (0.2–0.3 gm.); for a child, 1–3 gr. (0.06–0.2 gm.). It has been recommended in *intestinal catarrh*, but it is most too irritating for internal use. As an external remedy, however, it is not without value. A mixture of tannoform 1 part and Venetian talc 2 parts often acts very favorably in *excessive sweating of the feet*, especially when there is more or less maceration of the tissues.

## ACIDUM GALLICUM, U. S. P.

(Gallic acid; $HC_7H_5O_5 + H_2O$.)

Gallic acid is the hydrid of tannic acid, from which it is usually prepared by boiling with dilute sulphuric acid. It occurs in white or pale-fawn colored, silky needles, odorless, of an astringent or slightly acidulous taste, and permanent in the air. It is soluble in 84 parts of water, in 4 parts of alcohol, and in 12 parts of glycerin. It differs from tannic acid in not precipitating gelatin, albumin, or alkaloids. The dose is from 5–20 gr. (0.3–1.3 gm.) in powders or capsules.

**Physiologic Action and Therapeutics.**—Locally, gallic acid is a very feeble astringent, but as it does not coagulate blood, it cannot be recommended as a styptic. When taken internally, it is absorbed into the blood and is eliminated unchanged in the urine. It has an undeserved reputation as a remote astringent in checking hemorrhages from parts that can be reached only through the circulation, in controlling night-sweats, and in diminishing the excessive secretion of urine in diabetes insipidus.

**Incompatibles.**—Ferric salts, tartar emetic, lead acetate, silver nitrate, and spirit of nitrous ether.

## GALLA, U. S. P.

(Nutgall; Gall.)

Galls are excrescences produced by the stings and deposited ova of an insect in the bark or leaves of a plant. The official galls are caused by a species of *cynips*, which deposits its eggs in the tender shoots of *Quercus infectoria*, an oak growing in the countries bordering on the Mediterranean. Their therapeutic activities depend upon tannic acid, of which they contain from 30 to 60 per cent.

| Preparations. | Dose. |
|---|---|
| Tinctura Gallæ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Unguentum Gallæ, U. S. P. (20 per cent.). | |

**Therapeutics.**—Neither galls themselves nor the tin are at the present time used internally. Nutgall oint with equal parts of stramonium ointment is a time-hor remedy in *painful hemorrhoids.*

## KINO, U. S. P., KRAMERIA, U. S. P., AND GAMBIR, U. S. P.

Kino is the inspissated juice of *Pterocarpus Marsupi* large tree growing in the East Indies. The dose of the dered drug is from 5–30 gr. (0.3–2.0 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Tinctura Kino, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |

Krameria, or rhatany, is the root of *Krameria trian* low shrub growing on the mountains of Peru and Bolivia

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Krameriæ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Syrupus Krameriæ, U. S. P. (contains 45 per cent. by volume of the fluid extract) . | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Fluidextractum Krameriæ, U. S. P. . . . | 5–30 min. (0.3–2.0 c.c.) |
| Extractum Krameriæ, U. S. P. . . . . | 5–10 gr. (0.3–0.6 gm.). |
| Trochisci Krameriæ, U. S. P. (each contains about 1 gr.—0.06 gm.—of the extract). | |

Gambir is an extract prepared from the leaves and tw *Ourouparia Gambir*, a climbing plant of the East Indi was introduced into the Pharmacopeia to take the pl *catechu* (U. S. P. 1890), as the wood from which the la extracted is difficult to obtain.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Gambir Compositæ, U. S. P. (5 per cent., with Saigon cinnamon 2.5 per cent.) . . . . . | ½–2 fl. dr. (2.0–8.0 c.c.) |
| Trochisci Gambir, U. S. P. (each contains about 1 gr.—0.06 gm.). | |

**Therapeutics.**—All these drugs contain large amou tannic acid, to which their astringent properties are due. are sometimes employed to check excessive secretion i *diarrhea.* They should never be given, however, until the has been thoroughly cleared of irritant material. They ar prescribed with chalk and opium, as in the following fo

℞ Cretæ præparatæ, ℥ij (8.0 gm.);
Tincturæ opii deodorati, ♏xx (1.3 c.c.);
Tincturæ krameriæ, f℥ij (8.0 c.c.);
Acaciæ, q. s.;
Aquæ cinnamomi, q. s. ad f℥iij (90.0 c.c.). M
Sig. A teaspoonful every two or three hours for a chil years.

Troches of krameria or of gambir are useful in *relaxed sore throat.*

## GERANIUM, U. S. P.

(Cranesbill.)

Geranium is the rhizome of *Geranium maculatum*, a perennial herb growing in the woody places of North America. It contains from 10 to 28 per cent. of tannic acid.

| Preparation. | Dose. |
|---|---|
| Fluidextractum Geranii, U. S. P. . . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |

**Therapeutics.**—Geranium is the therapeutic equivalent of kino, krameria, and gambir, for which it may be substituted with advantage on account of its less disagreeable taste.

## HÆMATOXYLON, U. S. P.

(Hematoxylon; Logwood.)

Hematoxylon is the heart-wood of *Hæmatoxylon campechianum*, a small tree growing in Central America and the West Indies. Its chief constituents are tannin and a crystalline coloring principle, *hematoxylin.*

| Preparation. | Dose. |
|---|---|
| Extractum Hæmatoxyli, U. S. P. . . . . | 5–30 gr. (0.3–2.0 gm.). |

**Therapeutics.**—Logwood is used chiefly as an astringent in the *diarrhea of young children.* It is less active than kino, krameria, or gambir, but more agreeable on account of its sweetish taste. It has a disadvantage in staining the diapers a blood-red color. *Hematoxylin* is not used medicinally, but it is extensively used for its tinctorial properties in preparing tissues for microscopic study.

## RHUS GLABRA, U. S. P.

(Sumac.)

Sumac is the fruit of *Rhus glabra*, a shrub growing in waste places in North America. It contains, in addition to tannic acid, several acid mallates.

| Preparation. |
|---|
| Fluidextractum Rhois Glabræ, U. S. P. |

**Therapeutics.**—Sumac is never used internally, but the fluid extract, diluted with from 6 to 8 parts water, makes an excellent mouth-wash or gargle in *mercurial stomatitis* and in *acute pharyngitis*, especially if a small amount of potassium chlorate be added, as in the following formula:

℞ Potassii chloratis, ʒj (4.0 gm.);
Fluidextracti rhois glabræ, f ʒj (30.0 c.c.);
Aquæ, q. s. ad f ℥viij (250.0 c. c.).—M
Sig. Use as a gargle.

## QUERCUS, U. S. P.

(Quercus Alba; White Oak.)

Quercus is the bark of *Quercus alba*, a large tree gro in North America east of the Mississippi. It contains 5 to 10 per cent. of tannin and a bitter principle, *quercin*.

**Therapeutics.**—In the form of a decoction (1 oz. : 1 —30.0 gm. : 0.5 L.) it is occasionally used as a gargle in *throat* or as an injection in *leukorrhea*.

## HAMAMELIS.

(Witch-hazel.)

Hamamelis is official as the bark (*Hamamelidis C* and the dried leaves (*Hamamelidis Folia*) of *Hamameli giniana*, a shrub widely distributed throughout North Am It contains a volatile oil, a small amount of tannin, and a principle.

| Preparations. | Dose. |
|---|---|
| Fluidextractum Hamamelidis Foliorum, U. S. P. | ½–1 fl. dr. (2.0–4.0 |
| Aqua Hamamelidis, U. S. P. . . . . | 1–4 fl. dr. (4.0–15.0 |

**Physiologic Action and Therapeutics.**—Althoug aminations of witch-hazel have not revealed the presen any very active ingredient, the drug is credited with con able power as an astringent, a hemostatic, and a sed Dujardin-Beaumetz was of the opinion that it exerted a influence upon the muscular coats of the blood-vessel the investigations of Guy and of Wood indicate that it h such action. According to Ringer, large doses some cause severe headache.

Hamamelis water has a popular reputation as a t remedy for *sprains*, *bruises*, and *small wounds*. As an tion or lotion it makes a very soothing application in *p hemorrhoids*. Diluted with water, 1 part to 3, it is use benefit as a spray in *acute coryza*. Both the water an fluid extract have been used internally in various *hemor* with asserted good results.

## ALUMEN, U. S. P.

(Alum; Potassium Alum; Aluminum and Potassium Sulphate; $AlK(SO_4)_2 + 12H_2O$.)

The alum of the United States Pharmacopeia is a double sulphate of aluminum and potassium. In the British Pharmacopeia both this salt and the double sulphate of aluminum and ammonium are official. These compounds are of equal value. Potassium alum occurs in large, colorless, octahedral crystals, odorless, and of a sweetish and strongly astringent taste. It is freely soluble in water and in warm glycerin, but it is insoluble in alcohol. The usual dose is from 5–15 gr. (0.3–1.0 gm.), but as an emetic from 1–2 dr. (4.0–8.0 gm.) may be given.

PREPARATION.

Alumen Exsiccatum, U. S. P. (dried or burnt alum).

**Physiologic Action.**—When applied to the broken skin or to mucous membranes, alum acts as a powerful astringent, precipitating the albumin of the superficial cells, coagulating the fluids, and contracting the tissues. When used too freely or in the form of dried alum, it acts as an irritant. It forms a firm coagulum with blood, and thus tends to arrest hemorrhage. Taken internally in small doses it has an astringent effect and causes constipation. Large doses usually excite vomiting, but if retained, they induce gastro-enteritis.

**Therapeutics.**—Alum may be used as a local styptic in arresting *hemorrhages from small wounds.* A solution of from ½–1 dr. (2.0–4.0 gm.) to the pint (0.5 L.) is sometimes efficacious in *leukorrhea.* Insufflations of dried alum (1 : 20 of starch) or sprays of a weak solution—5–10 gr. (0.3–0.6 gm.) to the ounce (30.0 c.c.)—are sometimes of service in *subacute and chronic pharyngitis* and *laryngitis*, especially when there is much mucous secretion. Its prolonged use in the mouth is contraindicated on account of its destructive action on the teeth. Lotions of alum and diluted alcohol are sometimes employed in *hyperidrosis.* Dried alum has long been used as a mild caustic for destroying *exuberant granulations.*

Internally alum is no longer in use as an astringent. It is, however, a safe but somewhat uncertain emetic, and may be given to children in doses of a teaspoonful of the powdered drug in syrup, repeated once or twice if vomiting does not follow.

**Incompatibles.**—Alkalis and their carbonates, lead acetate, mercury, iron salts, and tannic acid.

## PLUMBUM.

(Lead; Pb.)

Metallic lead is obtained from a native sulphid and is official; the following preparations, however, are recognize the United States Pharmacopeia: Acetate, subacetate, c nitrate, and iodid.

**Physiologic Action.**—Upon the skin soluble lead- have little or no effect, but when applied to denuded surf or to mucous membranes, they act as astringents, combi with the albumin of the cells and fluids to form a delicate impervious coagulum. Unless applied in concentrated they exert, with the exception of the nitrate, a sedative r than a corrosive action.

Taken internally, single, moderate doses of lead ac have no action outside of the alimentary canal. They le sweetish, metallic taste in the mouth, with a feeling of dry and, owing to their astringent effects, they tend to cause stipation. Most of the drug escapes absorption and i charged in the stools in the form of a sulphid. In very doses lead acetate acts as an irritant poison and excites in the stomach, nausea and vomiting, great thirst, diarrhe more rarely, constipation, and collapse. Death is often ceded by coma and convulsions. The form in which l absorbed is not definitely known, but it is presumed t circulates as an albuminate. It is eliminated in the urine intestinal secretions, saliva, and milk, and probably, al the sweat. Ordinarily its excretion is effected rather sl so that its continuous absorption, even in small quantit liable to lead to an accumulation of the metal in the tiss

**Chronic Lead-poisoning or Plumbism.**—This dition may be brought about by the too prolonged use salts of lead for medicinal purposes, but it is much mo quently induced in workmen who are exposed to the or dust of lead, or who handle the metal or paints cont it. It may follow, also, the accidental introduction of lea the system through drinking-water, articles of food, hair and cosmetics.

Hard waters may be stored in cisterns lined with le may be conveyed through lead pipes without harm res since they soon deposit on the metal an insoluble coat lead sulphate; on the other hand, soft waters, especially containing considerable quantities of carbon dioxid, h dangerous lead-dissolving action.

**Symptoms of Chronic Poisoning.**—The most co

symptom is *colic* (*colica pictonum*). This condition consists in paroxysms of severe abdominal pain, with retraction and rigidity of the abdominal muscles and obstinate constipation, although rarely there may be diarrhea. During the attacks there is often a marked increase in the arterial tension and slowing of the pulse. A characteristic feature of plumbism is the *blue line* on the edge of the gums near the insertion of the teeth. This discoloration is due to the deposit of lead sulphid formed from the sulphureted hydrogen evolved in the decomposition of particles of food. Perfect cleanliness of the teeth may prevent its appearance. *Lead palsy* is of common occurrence. It usually attacks the muscles supplied by the musculospiral nerve,—the extensors of the fingers and of the wrist,—causing the so-called "wrist drop." The affected muscles ultimately atrophy and yield the reactions of degeneration. Occasionally other muscles are involved, such as the extensors of the legs, the recti of the eye, and the adductors of the larynx. Lead-paralysis usually results from peripheral neuritis; in some instances, however, there appears to be also degeneration of the ganglionic cells of the spinal cord, but whether this is primary or is secondary to the neuritis has not been determined.

*Anemia* is rarely absent. Both the hemoglobin and the number of red cells are decreased, and, moreover, as Grawitz has shown, the red cells usually contain numerous basophilic granules.

*Cerebral symptoms* (*encephalopathia saturnina*) occasionally occur. They include persistent headache, epileptiform convulsions, delirium, optic neuritis, stupor, and coma. A symptom-complex resembling paretic dementia has also been described. In some instances the cerebral symptoms are simply expressions of uremia, but in others they are the consequence, without doubt, of the toxic action of the lead itself. McCarthy has observed in dogs poisoned by lead degeneration of the ganglion-cells, increase in the gliar elements, and marked endarteritis. Finally, workers in lead are especially prone to *chronic nephritis with arteriosclerosis* and to *gouty arthritis*.

**Treatment of Lead-Poisoning.**—*Acute Poisoning.*—The stomach should be emptied by means of the stomach-pump, unless vomiting has rendered this procedure unnecessary. A soluble sulphate (Epsom or Glauber's salt) is a chemical antidote, forming with the lead an insoluble sulphate; it should be given in excess, so that a purgative effect may also be secured. The resulting gastro-enteritis should be treated by

the application of warm fomentations and by the adminis tion of opium and demulcent drinks.

*Chronic Poisoning.*—Much may be done to prevent plu ism in lead-work establishments. Absolute cleanliness, e cially of the hands and nails, is of the utmost importa Fans and suitable means of ventilation should be prov wherever dust is generated. Respirators should be wor persons employed in dry processes. No food should be e in any part of the works.

Curative treatment consists in eliminating the poison ar relieving the immediate symptoms. Potassium iodid, in d of from 5–15 gr. (0.3–1.0 gm.) thrice daily, is employe meet the first indication. Sulphur baths are also recommer They are prepared by mixing in a wooden tub 3 or 4 (90.0–125.0 gm.) of potassium sulphuret with about 20 ga (75.0 L.) of water. Constipation should be relieved by s cathartics, preferably by Epsom salts, or, if necessary, by e rium. Colic will require hot applications and hypode injections of morphin and atropin. For the paralysis, mas electricity, and strychnin should be used.

### PLUMBI ACETAS, U. S. P.

(Lead Acetate; Sugar of Lead; $Pb(C_2H_3O_2)_2 + 3H_2O$.)

Lead acetate occurs in heavy, colorless, efflorescent, matic crystals or crystalline masses, having a sweetish, me taste, and a faintly acetous odor. It is soluble in 2 par water and in 30 parts of alcohol. The dose is from 1- (0.065–0.26 gm.) in pills.

**Therapeutics.**—Internally, pills of lead acetate and c are sometimes useful in controlling *subacute* and *chronic rhea*. Solutions of from 1–5 gr. (0.06–0.3 gm.) to the (30.0 c.c.), employed as injections, are of service in the st ary stage of *gonorrhea*.

The well-known "lead-water and laudanum" is u made of the subacetate of lead, but the acetate may be stituted with advantage, as in the following formula:

℞ Plumbi acetatis, ℥j (4.0 gm.);
Tincturæ opii, f℥j (30.0 c.c.);
Aquæ, q. s. ad f℥viij (236.0 c.c.).—

Although the ingredients in this combination are chem incompatible, the mixture makes a useful sedative ap tion in *bruises*, *sprains*, *superficial inflammation*, and *erys*

**Incompatibles.**—Acids, alkalis, sulphates, carbonates, chlorids, and tannin.

### PLUMBI SUBACETAS.

(Lead Subacetate; $Pb_2O(C_2H_3O_2)_2$.)

The subacetate of lead is so unstable that it is employed only in solution.

PREPARATIONS.

Liquor Plumbi Subacetatis, U. S. P. (Goulard's extract: contains 25 per cent. of lead subacetate).

Liquor Plumbi Subacetatis Dilutus, U. S. P. (lead-water: contains 1 per cent. of lead subacetate).

Ceratum Plumbi Subacetatis, U. S. P. (Goulard's cerate: contains 20 parts each of the solution of lead subacetate, wool-fat, and paraffin; 38 parts of white petrolatum, and 2 parts of camphor.

**Therapeutics.**—The solution of the subacetate of lead, diluted with 3 or 4 parts of water, is employed as a sedative lotion in *acute eczema*, *rhus poisoning*, and *erysipelas*. The official diluted solution is too weak to be of much service, although it is often used in preparing "lead-water and laudanum" (2 parts of lead-water to 1 part of laudanum). The cerate is occasionally used as an application for *chapped hands*.

### OLEATUM PLUMBI.

(Oleate of Lead; $Pb2C_{18}H_{33}O_2$.)

Oleate of lead is official as lead-plaster (*Emplastrum Plumbi*), which is prepared by stirring together hot solutions of lead acetate and soap. Lead plaster makes a useful protective dressing for *superficial ulcers* and *bed-sores*. An ointment composed of equal parts of lead-plaster and of vaselin makes an efficacious application in *subacute eczema* and *hyperidrosis*. In the latter affection, after the parts have been cleaned and dried, the ointment should be applied on strips of muslin, and renewed twice daily for two or three weeks, instructions being given to avoid washing the feet in water during the progress of the treatment. Lead-plaster also enters into diachylon ointment (*Unguentum Diachylon*, U. S. P.) and into all of the official plasters.

### PLUMBI NITRAS, U. S. P.

(Lead Nitrate; $Pb(NO_3)_2$.)

Lead nitrate occurs in white, translucent, octahedral crystals, odorless, and of a sweetish, astringent, and metallic taste. It is soluble in 2 parts of water.

**Therapeutics.**—At the present time lead nitrate is employed only as a caustic in the treatment of *onychia*. It is usually applied as a powder.

### PLUMBI IODIDUM, U. S. P.

(Lead Iodid; $PbI_2$.)

Lead iodid is a heavy, bright yellow powder, odorless and sparingly soluble in water and in alcohol. It owes its activity more to the iodin element than to the lead, and is used only as a local absorbent (see p. 317).

### PLUMBI OXIDUM, U. S. P.

(Lead Oxid; Litharge; PbO.)

Lead oxid is a heavy, reddish-yellow powder, odorless and tasteless, and insoluble in ordinary menstrua.

It is rarely employed except in preparing the solution of lead subacetate (*Liquor Plumbi Subacetatis*, U. S. P.).

### CUPRI SULPHAS, U. S. P.

(Copper Sulphate; Blue Vitriol; $CuSO_4 + 5H_2O$.)

Copper sulphate occurs in large, transparent, deep-blue crystals, odorless, and of a nauseous, metallic taste. It is soluble in 2.2 parts of water and in 400 parts of alcohol. The dose as an astringent is from $\frac{1}{4}$–1 gr. (0.016–0.06 gm.); as an emetic, 5–10 gr. (0.3–0.6 gm.).

**Physiologic Action.**—Upon mucous membranes and raw surfaces copper sulphate in dilute form acts as an astringent; in concentrated forms it acts as a mild caustic. Taken internally in large doses it causes emesis by its direct irritant action on the stomach.

**Toxicology.**—Acute copper-poisoning is characterized by severe abdominal pain, a metallic taste in the mouth, and violent vomiting and purging, the ejecta often being mucous and bloody. Death may be preceded by delirium, convulsions, and coma. The bluish or greenish color of the vomit may serve to distinguish it from poisoning by other irritants. After death the gastro-intestinal tract is found to be intensely inflamed, and sometimes ulcerated. Unless death occurs quite promptly, there may be found also fatty changes in the liver and kidneys.

**Treatment.**—The antidotes are potassium ferrocyanid, magnesia, sodium carbonate, and soap. Demulcents like milk and eggs should be given freely. Opium will be required to relieve the pain.

Chronic copper-poisoning is of doubtful occurrence; it is said to occasion gastro-intestinal disturbances, cachexia, a green line on the gums, and a greenish discoloration of the hair.

**Therapeutics.**—Copper sulphate is a prompt and powerful emetic, but it is most too irritant for ordinary use. When administered once without effect it is best not to repeat the dose. In *phosphorus poisoning* it is useful not only as an emetic, but also as an antidote, since it forms on the phosphorus an insoluble coating.

In *indolent ulcers, ulcerative stomatitis, chronic granular conjunctivitis* (*trachoma*), light applications of the solid crystal are often very useful for their stimulant effects. In *gonorrhea*, after the acute symptoms have subsided, an injection containing 2 gr. (0.13 gm.) to the ounce (30.0 c.c.), gradually increased in strength, is quite efficacious.

Internally, in pill form combined with opium, it is sometimes of service in *obstinate chronic diarrhea.*

## ZINCUM, U. S. P.

(Zinc; Zn.)

Metallic zinc is official in the form of thin sheets, or in irregular granulated pieces, or molded into thin pencils, or in a state of fine powder. The metal itself is not used medicinally.

### ZINCI SULPHAS, U. S. P.

(Zinc Sulphate; White Vitriol; $ZnSO_4 + 7H_2O$.)

Zinc sulphate occurs in colorless, transparent, rhombic crystals, odorless, and of an astringent metallic taste. It is soluble in 0.53 part of water and in 3 parts of glycerin, and is insoluble in alcohol. The dose as an astringent is from $\frac{1}{2}$–3 gr. (0.03–0.2 gm.); as an emetic, 10–30 gr. (0.6–2.0 gm.).

**Physiologic Action.**—In weak solution zinc sulphate exerts an astringent effect; in concentrated solution, an irritant or caustic effect. Administered by the mouth, large doses (20 gr.—1.3 gm.) excite emesis through their action on the stomach. Toxic doses induce severe gastro-enteritis.

The **treatment of poisoning** consists in the free exhibition of alkalis or their carbonates, and of demulcents like eggs and milk.

**Therapeutics.**—A solution containing ½ gr. (0.03 g gradually increased to 5 or 6 gr. (0.3–0.4 gm.) to the ounce ( c.c.) makes an excellent injection in *gonorrhea* after the sidence of acute symptoms. Weak solutions are sometime service in leukorrhea.

℞ Zinci sulphatis, Aluminis, Glycerini, aa ℥iss (5.8 gm.); f℥vj (180.0 c.c.).—M.
Sig. Add a tablespoonful to a quart of hot water, and use injection.

A solution of from 1–2 gr. (0.06–0.1 gm.) to the ounce c.c.) is a favorite collyrium in the later stages of *simple con tivitis.*

Internally, zinc sulphate is used as an emetic (see p. and very rarely as an astringent in *chronic diarrhea.*

**Incompatibles.**—Alkalis and their carbonates, vege astringents, lead acetate, silver nitrate, and lime-water.

### ZINCI ACETAS, U. S. P.

(Zinc Acetate; $Zn(C_2H_3O_2)_2 + 2H_2O$.)

Zinc acetate occurs in thin, colorless, six-sided plates pearly luster, an acetous odor, and an astringent, metallic It is soluble in 2.5 parts of water and in 36 parts of alc It is used as an astringent for the same purposes as sulphate.

### ZINCI OXIDUM, U. S. P.

(Zinc Oxid; ZnO.)

Zinc oxid is an amorphous white powder, free from and taste, and insoluble in water and in alcohol. The d from 1–5 gr. (0.06–0.3 gm.) in pill.

PREPARATION.

Unguentum Zinci Oxidi, U. S. P. (contains 20 per cent. of zinc oxid

**Therapeutics.**—The ointment of zinc oxid is exten used as a slightly astringent and protective dressing for *acute ulcers*, and *acute inflammatory skin diseases.* Du powders containing zinc oxid, starch, and Venetian t various proportions, are very serviceable in *vesicular e* and in *erythema intertrigo.*

℞ Zinci oxidi, Talci purificati, Pulveris amyli, aa ℥j (4.0 gm.); ℥ij (8.0 gm.).—M.

Internally, zinc oxid has been employed as an antispasmodic and an antihydrotic, but it is useless for either of these purposes.

### ZINCI CARBONAS.

(Zinc Carbonate; $2ZnCO_3 . 3Zn(OH)_2$)

Zinc carbonate is official in the form of precipitated zinc carbonate (*Zinci Carbonas Præcipitatus*, U. S. P.), which is an impalpable white powder, of variable composition, odorless and tasteless, and insoluble in ordinary menstrua.

An impure precipitated carbonate of zinc, known as *calamin*, was formerly official (1860).

**Therapeutics.**—Zinc carbonate resembles zinc oxid in appearance and in therapeutic properties. It is chiefly employed as a sedative and protective application in *acute inflammatory* affections of the skin, such as *eczema*, *erythema intertrigo*, and *dermatitis venenata*. It is often combined with zinc oxid, as in the following formula:

℞ Zinci carbonatis præcipitati,
Zinci oxidi, aa ʒiiss (10.0 gm.);
Glycerini, fʒj (4.0 c.c.);
Liquoris calcis, fʒij (60.0 c.c.);
Aquæ rosæ, q. s. ad fʒvj (178.0 c.c.).—M.

### ZINCI CHLORIDUM, U. S. P.

(Zinc Chlorid; $ZnCl_2$)

Zinc chlorid occurs in white, granular powder or porcelain-like masses, or molded pencils, very deliquescent, odorless, and of a caustic metallic taste. It is freely soluble in water and in alcohol.

PREPARATION.

Liquor Zinci Chloridi, U. S. P. (50 per cent. by weight of zinc chlorid).

**Therapeutics.**—Zinc chlorid is the least astringent and the most caustic of the zinc salts. At present it is rarely employed except as an escharotic in removing *superficial epitheliomata*. Its action is rather slow, and is attended with severe pain. It is best applied in the form of a paste, which may be made by mixing 1 part of zinc chlorid and 3 parts of flour with a saturated solution of cocain hydrochlorid.

The solution of zinc chlorid has an unmerited reputation as a disinfectant.

## ARGENTUM.

(Silver; Ag.)

The following preparations of silver are official: Silver cyanid (*Argenti Cyanidum*, U. S. P.), silver nitrate (*Argenti*

*Nitras*, U. S. P.), and silver oxid (*Argenti Oxidum*, U. S.
Of these, the only one of any importance is silver nitrate.

### ARGENTI NITRAS, U. S. P.

(Silver Nitrate; Lunar Caustic; $AgNO_3$.)

Silver nitrate occurs in colorless, transparent, tabular, rh
bic crystals, odorless, of a caustic metallic taste, and solub
0.54 part of water and in 4 parts of alcohol. It turns dar
exposure to light. The dose is from $\frac{1}{6}$–$\frac{1}{2}$ gr. (0.01–0.03 g

PREPARATIONS.

Argenti Nitras Fusus, U. S. P. (silver nitrate molded into hard, whit
cones or pencils).
Argenti Nitras Mitigatus, U. S. P. (mitigated caustic; molded cones
pencils of silver nitrate and potassium nitrate, containing about
per cent. of the former).

**Physiologic Action.**—When applied undiluted to
skin, silver nitrate acts as a superficial escharotic, produc
white slough which subsequently turns black on exposu
light. Upon mucous membranes and raw surfaces it a
dilute form as an unirritating astringent, precipitating
albumin of the cells with which it comes in contact, and
tracting the blood-vessels; in concentrated form it acts
caustic, coating the part with a white pellicle of silver al
nate. Its corrosive action, however, never extends very d
on account of the impenetrable nature of the coagulum
at once formed.

Silver nitrate is an active germicide, solutions of 1
destroying the organisms of diphtheria, cholera, glander
typhoid fever in two hours.

When taken internally in medicinal doses, it exerts no
influence than that of an astringent and an antiseptic.
so readily precipitated by chlorids, proteids, and aci
astringent action is chiefly expended on the mucous men
of the stomach. The bulk of it escapes absorption, but
small percentage enters the circulation is evident from t
that the prolonged use of the drug is followed by a dep
silver in the skin and internal organs. Very little is
concerning its elimination; it is supposed to be ex
slowly and imperfectly in the urine.

**Toxicology.**—In large doses silver nitrate acts
irritant poison, producing intense abdominal pain, pe
vomiting and purging, and collapse. White or blackish
may be present on the lips and mucous membrane

mouth. Death is sometimes preceded by delirium, convulsions, and coma.

**Treatment.**—Common salt is the best antidote. It forms with the poison an insoluble and inert chlorid of silver. Demulcents should also be used freely.

**Argyria.**—The long-continued use of silver nitrate, either internally or locally, may result in the permanent deposition of dark granules of metallic silver in various tissues of the body. This pigmentation is known as argyria. Clinically, its chief manifestation is a peculiar, bluish-gray discoloration of the skin and mucous membranes. In the majority of cases there is no impairment of the general health. It is incurable.

**Therapeutics.**—At the present time silver nitrate is chiefly used for its action on *inflamed mucous membranes* and *ulcerated surfaces*. In *chronic ulcers* a solution of from 10 to 40 grains to the ounce (0.6–2.6 gm. to 30.0 c.c.) or the solid stick may be employed as a stimulant application. Silver nitrate is perhaps the best caustic for removing *exuberant* or *superfluous granulations*. Its employment in *poisoned wounds*, especially in the punctured variety, and in those resulting from the bites of rabid animals, is to be condemned on account of its superficial action and the premature closure of the orifice. A strong solution (30 gr. to 1 oz.—2.0 gm. to 30.0 c.c.) will sometimes abort a *felon* if applied early. In *acute epididymitis* counter-irritation may be secured by drawing a pencil of lunar caustic several times over the posterior surface of the scrotum, but this treatment is less efficacious than the application of guaiacol (p. 286). The treatment of *erysipelas* by local applications of silver nitrate, so highly recommended by Higginbottom, has few advocates at the present time.

In *simple conjunctivitis*, when the discharge has become mucopurulent, the membrane may be painted with a solution containing from 3 to 5 grains to the ounce (0.2–0.3 to 30.0 c.c.). In *purulent ophthalmia* and *ophthalmia neonatorum* the conjunctiva, after being thoroughly cleansed, may be touched with a 10-grain solution (0.65 gm. to 30.0 c.c.). Credé's prophylactic treatment, which consists in the instillation of 2 drops of a 2 per cent. solution into the eyes of the new-born child when gonorrhea in the mother is suspected, has given excellent results. It must be remembered that the long-continued use of collyria containing silver nitrate may be followed by permanent discoloration of the conjunctiva.

Copious irrigation of the urethra with hot solutions of silver nitrate (1 : 10,000) has been found serviceable in both *acute* and

*subacute gonorrhea.* Excellent results are obtained in *ch cystitis* by washing out the bladder first with distilled wate then with a solution of silver nitrate (1 : 8000).

Solutions varying in strength from 10 to 60 grains t ounce (0.6–4.0 gm. to 30.0 c.c.) are extensively employe the treatment of *chronic stomatitis*, *chronic pharyngitis*, *chronic laryngitis*. Light touches of the solid stick act favorably upon *mucous patches*.

In *chronic dysentery* great benefit often follows the us copious injections into the bowel of solutions of silver n (10–30 grains to the pint—0.65–2.0 gm. to 0.5 L.). The jections should be given two or three times a week, the being introduced very slowly through a tube passed we into the bowel. At first the amount injected should nc ceed 2 pints (1.0 L.), but later 4 or 5 pints (2.0–2.5 L.) m employed with advantage.

Internally, silver nitrate is employed chiefly for its action on the gastro-intestinal tract. In *chronic gastric c* and in *ulcer of the stomach* no remedy, with the excepti bismuth subnitrate, is so generally useful. In obstinate c of the stomach, especially when there is supersecreti marked hyperesthesia of the mucous membrane, douchi stomach once or twice a week, first with a solution of nitrate (1 : 5000 to 1 : 2000) and then with plain wate valuable method of treatment. About a pint (0.5 L.) solution should be introduced through the douche a operation. Silver nitrate is also used in *acute* and *chro teritis*, but with less benefit than in inflammatory disea the stomach.

The treatment of *epilepsy*, *locomotor ataxia*, and *cho* the administration of the salts of silver possesses little than a historic interest.

**Administration.**—In affections of the stomach silv rate should be given in pill form, half an hour before Powdered opium or extract of hyoscyamus may be use excipient. When intended to act in the bowel, it sho given in keratin-coated pills. The administration of should not be continued for a longer period than eight weeks without interrupting the treatment for period.

**Incompatibles.**—Organic matter, bromids, chlorids, cyanids, sulphids, carbonates, phosphates, arsenites, and chloric acid. With creasote it is explosive.

**Organic Silver Salts and Soluble Silver.**—M tempts have been made recently to produce compound

ver that will not precipitate albumins and chlorids, and yet will retain the germicidal properties of the metal. The most important compounds of this class thus far introduced are argentamin, silver lactate (actol), silver citrate (itrol), protargol, argyrol, and largin. In addition to these, Créde has also suggested a soluble allotropic form of silver (argentum solubile). The therapeutic value of these preparations has not yet been definitely determined.

**Argentamin.**—This is a solution of silver nitrate (10 per cent.) in an aqueous solution of ethylendiamin (10 per cent.), the purpose of the ethylendiamin being to prevent the precipitation of the salt by albumins and chlorids. Like other silver preparations, it is decomposed by light. It has been used chiefly in *gonorrhea* and in *conjunctivitis*; in the former, in solutions of from 1 : 2000 to 1 : 100, and in the latter, in solutions of from 3 to 5 per cent. In the eye its action is somewhat irritating.

**Silver Lactate (Actol).**—This is a white powder, free from odor and taste, and soluble in about 20 parts of water. It is a powerful germicide, solutions of 1 : 1000 destroying most microorganisms within five minutes. Solutions of from 1 : 1000 to 1 : 500 have been employed for injection in *gonorrhea*, but they have proved very irritating.

**Silver Citrate (Itrol).**—This salt resembles the lactate in appearance, but as it is almost insoluble in water, it is much less irritating. It has been used as an antiseptic dusting-powder for wounds, and in solution (1 : 5000) as a disinfectant for instruments and the skin.

**Protargol.**—This is a proteid compound of silver containing about 8 per cent. of metallic silver. It is a fawn-colored powder, freely soluble in water. It is an energetic germicide and comparatively free from irritant properties. It has been used quite extensively and with good results in *purulent conjunctivitis* (1 to 10 per cent. solution), in *gonorrhea* (0.25 per cent. solution gradually increased to 2 per cent.), and in *suppurative middle-ear disease* (3 to 5 per cent. solutions).

**Argyrol (Silver Vitellin).**—This is a compound of silver and a vegetable proteid containing 30 per cent. of metallic silver. Its high percentage of silver (nearly four times that of protargol), extreme solubility, and comparative freedom from irritant properties make it one of the most serviceable of the organic silver compounds. In solutions of from 5 to 25 per cent. it has been used with considerable success in both *acute* and *chronic gonorrheal infections*, *purulent conjunctivitis*, and *suppurative affections of the ear*, *nose*, and *throat*.

**Largin.**—This is also a proteid compound of silver. It is

a grayish powder, freely soluble in water, containing abou per cent. of metallic silver. It has been used with ass good results in *gonorrhea* (0.5 to 1.5 per cent. solution) a *purulent ophthalmia* (1 to 10 per cent. solution).

**Soluble or Colloidal Silver (Argentum Colloidale, C gol).**—This is an allotropic form of silver, occurring in h greenish-black particles, readily soluble in water, form reddish-brown solution. It is most commonly used i form of a 15 per cent. ointment, known as Credè's oint which has been found of service as a local remedy in such ditions as *erysipelas*, *lymphadenitis*, *septic phlebitis*, and *g rheal arthritis*. With the view of producing a constitu impression, daily inunctions of the ointment (45 gr.—3.0 have also been employed in various septic processes, bu method of using the drug is not very promising.

## BISMUTHUM.

(Bismuth; Bi.)

The following preparations of bismuth are official: Bis subnitrate (*Bismuthi Subnitras*, U. S. P.), bismuth subcarb (*Bismuthi Subcarbonas*, U. S. P.), bismuth subgallate (*Bis Subgallas*), bismuth subsalicylate (*Bismuthi Subsalicylas* muth citrate (*Bismuthi Citras*, U. S. P.), and bismuth a nium nitrate (*Bismuthi et Ammonii Citras*, U. S. P.). A bismuth preparations are useful largely on account of insolubility, the soluble salts—bismuth citrate and bis and ammonium citrate—seem to be superfluous. A compounds of bismuth which are in use, but which ar official, may be mentioned tribromphenol-bismuth (xero and betanaphthol-bismuth (orphol). These will be cons in the section devoted to Germicides and Antiseptics (p.

### BISMUTHI SUBNITRAS, U. S. P.

(Bismuth Subnitrate; $BiONO_3+H_2O(?)$.)

Bismuth subnitrate is a heavy white powder, of a som varying composition, odorless, almost tasteless, and perm in the air. It is insoluble in water and in alcohol. Th is from 5–40 gr. (0.3–2.6 gm.).

**Physiologic Action.**—When taken internally, e very large doses, the effects of bismuth subnitrate are co to the mucous membrane of the alimentary canal, its being that of a feeble astringent and protective. Since of the metal have been found in the urine there must be absorption, but the amount of the drug entering the is undoubtedly too small to exert any special infl Worden, Sailer, and Pancoast have reported six cases in

alarming symptoms were observed after 2 to 4 ounces (60.0–120.0 gm.) of perfectly pure bismuth subnitrate had been given for diagnostic purposes. It is suggested, however, that the symptoms were due to the formation of nitrites in the intestines, as they were quite unlike those produced by heavy metals. The characteristic black stools following the administration of the drug are attributed to its partial conversion into a sulphid in the intestine. The breath of patients taking bismuth sometimes acquires a peculiar garlicky odor; this is due, as Reisert has demonstrated, to the minute tellurium impurities often present in commercial bismuth compounds.

Upon the unbroken skin bismuth subnitrate acts simply as a protective, but on raw surfaces it acts also as an astringent and antiseptic. Absorption takes place rather readily from denuded parts, and poisoning may occur if the drug be applied too freely. The symptoms of bismuth poisoning are salivation, stomatitis, dysphagia, a black discoloration of the mucous membrane of the mouth, ulceration of the throat, diarrhea, and albuminuria.

**Therapeutics.**—No drug is so generally useful as bismuth subnitrate in allaying *gastric irritation* from various causes. It is a standard remedy in both *acute* and *chronic gastric catarrh* and in *gastric ulcer*. In the latter affection excellent results are often obtained by giving a single daily dose of from 1–2 dr. (4.0–8.0 gm.) in the morning, on an empty stomach, and then having the patient assume various positions—on the back, on the right, and on the left side, remaining in each position for five or ten minutes. In many cases of ulcer an alkali, such as sodium bicarbonate or magnesia, may be added with advantage. Even in *gastric cancer* the drug sometimes affords temporary relief. It is of much service in *gastralgia* dependent upon excessive acidity of the stomach. *Vomiting* the result of gastric irritation generally yields to it. It is especially efficacious as an antiemetic when conjoined with diluted hydrocyanic acid.

In *catarrhal diarrhea*, after the intestine has been thoroughly emptied, bismuth subnitrate is invaluable as a protective and an astringent. In these cases it may be combined advantageously with morphin and an antiseptic, as in the following formula:

℞ Morphinæ sulphatis, gr. j (0.06 gm.);
Salol, gr. xxx (2.0 gm.);
Bismuthi subnitratis, ℥vj (24.0 gm.). M.
Fiant chartulæ No. xv.
Sig. One every three hours.

Topically, bismuth subnitrate, alone or with starch, may be used as a dusting-powder in *acute erythema* and in *intertrigo*. In the form of a paste made with glycerin and water it has

been employed rather extensively also as a protective dres for *burns;* in a number of instances, however, such app tions have been followed by poisoning. In the *second stag gonorrhea* injections of bismuth subnitrate, 15 gr. (1.0 gm the ounce (30.0 c.c.) of glycerin and water, have a favor action.

In *acute coryza* a snuff composed of bismuth subnitrate, acacia, and a little morphin sometimes affords relief.

**Administration.**—It is usually prescribed in powder in capsules. Very large doses, however, may be given veniently in water, the mixture being well shaken before administration. Alkaline bicarbonates and sodium hypo phite are incompatible with such mixtures. In affection the stomach the drug should be taken half an hour b meals.

### BISMUTHI SUBCARBONAS, U. S. P.

(Bismuth Subcarbonate; $(BiO)_2CO_3 + H_2O$ (?).)

Bismuth subcarbonate closely resembles bismuth subni in its physical properties and action. Its uses and dos the same as those of the subnitrate. When an enormous of a bismuth salt is required, as in the skiagraphic examina of the stomach and intestines, the subcarbonate shoul selected in preference to the subnitrate, as being less likel cause ill-effects from decomposition.

### BISMUTHI SUBGALLAS.

(Bismuth Subgallate; Dermatol; $C_6H_2(OH)_3CO_2Bi(OH)_2$.)

Bismuth subgallate is a fine, yellowish-white powder, less and tasteless, permanent, and insoluble in ordinary vents. It should contain not less than 52 per cent., nor than 57 per cent., of bismuth oxid. The dose is from 5–3 (0.3–2.0 gm.).

**Therapeutics.**—Bismuth subgallate has been empl somewhat extensively as a protective and an astringent a cations for *burns* and *moist eczema.* It does not appear, ever, to have been less harmful than other bismuth compo when used externally. Internally it has been used instea the subnitrate in *catarrhal affections of the stomach and inte* but it has no advantages over the official preparation.

### BISMUTHI SUBSALICYLAS, U. S. P.

(Bismuth Subsalicylate; $Bi(C_7H_5O_3)_3Bi_2O_3$.)

Bismuth subsalicylate is a white amorphous or crysta powder, odorless and tasteless, and insoluble in water. used chiefly as an intestinal antiseptic and astringen *diarrhea.* The dose is from 5–20 gr. (0.3–1.3 gm.).

## CALCII CARBONAS.

(Calcium Carbonate; Chalk; $CaCO_3$.)

Chalk is official in two forms: Precipitated calcium carbonate (*Calcii Carbonas Præcipitatus*, U. S. P.) and prepared chalk (*Creta Præparata*, U. S. P.). The dose of either preparation is from 10–40 gr. (0.65–2.3 gm.) or more.

| PREPARATIONS. | DOSE. |
|---|---|
| Pulvis Cretæ Compositus, U. S. P. (prepared chalk, 30; acacia, 20; sugar, 50) | 5–40 gr. (0.3–2.3 gm.). |
| Mistura Cretæ, U. S. P. (compound chalk powder, 20; cinnamon water, 40; water, q. s. 100) | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Hydrargyrum cum Creta, U. S. P. (57 per per cent. of chalk) | ½–10 gr. (0.03–0.6 gm.). |

**Therapeutics.**—Chalk is a mild astringent and antacid, free from irritant properties. It may be employed in *acute inflammatory diarrhea* in the same manner as bismuth subnitrate. It is an excellent antacid when acidity of the stomach is associated with relaxation of the bowels. It may be prescribed as an *antidote* in poisoning by a *mineral acid* or by *oxalic acid*.

Externally, it is used as a dusting-powder in *erythematous eczema* and *intertrigo*. It is particularly useful in the *chafing of the genitalia and buttocks* of young children from irritation by urine. It enters into the composition of most *tooth-powders*.

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# HEMOSTATICS.

Hemostatics are agents that arrest hemorrhage. They all act in accordance with the methods pursued by nature in spontaneously closing a bleeding vessel. If an artery be divided, it shrinks within its sheath, the contiguous structures fall in upon the bleeding orifice, and if the hemorrhage be copious, the force of the circulation diminishes and the coagulability of the blood increases. The choice of the hemostatic will largely depend upon the seat of the hemorrhage—that is, whether it is in an accessible or in an inaccessible region, and upon its source—that is, whether it is of capillary, of venous, or of arterial origin. Hemorrhage from a large vessel in an accessible region should always be controlled by *mechanical* means—that is, by ligature, torsion, pressure, acupressure, or cauterization. Many parts formerly considered inaccessible are

no longer so regarded, and to-day surgical aid is some
wisely invoked to arrest excessive bleeding from such o
as the stomach and bowel, and even the brain.

Small external hemorrhages, especially capillary oozin
often satisfactorily controlled by the direct application of a
that contract the vessels or that coagulate the albumin c
blood. The most potent local vasoconstrictors are *cold*, i
form of water or of ice, and *adrenalin;* and the most pov
styptics are *ferric subsulphate*, *ferric chlorid*, *alum*, and *tanni*

Three classes of drugs have been recommended to c
hemorrhage in organs that must be reached through th
culation. The first includes drugs like tannic acid and c
mineral salts, which have been found useful as local styp
astringents; the second, drugs like *ergot*, which cause
constriction by stimulating the vasomotor centers or by
directly on the muscular walls of the vessels; and the
drugs like *gelatin* and *calcium chlorid*, which are thoug
increase the natural coagulability of the blood.

There is no reason to believe that tannic acid exerts a
fluence as a hemostatic outside of the alimentary canal
it enters the blood in such a form (*gallic acid*) that it lo
styptic and astringent properties. As regards the n
astringents, it is exceedingly doubtful whether any one o
can enter the circulation in sufficient quantity to exert a
able influence upon a hemorrhage in a territory remot
the point of absorption. Owing to its power of causing
traction of the unstriped muscle of the uterus, ergot is u
tionably of value in controlling certain forms of metror
but the testimony to its efficacy in other internal hemorr
such as hemoptysis and hematuria, is not convincing.
ing that it has the power of causing vasoconstriction th
a central influence, it is unreasonable to suppose that its
are limited to the vessel concerned in the bleeding, and
be not the case, it should tend to do harm rather than
since a universal narrowing of the blood-paths and a
quent rise in the blood-pressure must favor the escape o
and also hinder the formation of an occluding thrombus
ergot, *hydrastinin* and *cotarnin* also act as vasoconst
While clinical experience has shown them to be of v
some forms of metrorrhagia, it is doubtful whether they
any avail in bleeding from other organs. Gelatin and c
chlorid have recently been recommended as internal
statics on the ground that they increase the normal co
bility of the blood. The former appears to be more

than the latter, but sufficient time has not yet elapsed to allow of any decided opinion of its efficacy.

In the treatment of internal hemorrhage absolute rest of body and mind is essential. An ice-bag may be applied over the seat of the bleeding. *Opium* is of great value; it not only exerts a calmative effect, but it also serves to control involuntary movements, such as cough and peristalsis. For the purpose of lowering the blood-pressure a ligature may be applied to a leg or an arm. For the profound anemia which accompanies or follows profuse hemorrhage normal salt solution may be given subcutaneously.

The only drugs employed as hemostatics which have not been considered in other sections are hydrastis, cotarnin, gelatin, and calcium chlorid.

## HYDRASTIS, U. S. P.

(Golden Seal.)

Hydrastis is the rhizome and root of *hydrastis canadensis*, a perennial herb growing in the woods of North America east of the Mississippi. It contains *hydrastin*, *berberin*, and *canadin*. Of these hydrastin is official as *Hydrastina*. By oxidizing hydrastin with potassium permanganate the artificial alkaloid *hydrastinin* is obtained, which is official as *Hydrastininæ Hydrochloridum*. The dose of crystalline hydrastin is from $\frac{1}{6}$–$\frac{1}{2}$ gr. (0.01–0.03 gm.); of hydrastinin hydrochlorid, from $\frac{1}{4}$–1 gr. (0.016–0.06 gm.).

| Preparations. | Dose. |
|---|---|
| Fluidextractum Hydrastis, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Tinctura Hydrastis, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Glyceritum Hydrastis, U. S. P. | ½–2 fl. dr. (2.0–8.0 c.c.). |

**Physiologic Action.**—Hydrastis owes its activities largely to the presence of the alkaloid hydrastin. The latter is first an excitant and then a paralyzant of the spinal cord, consequently toxic doses are followed first by tetanic convulsions and later by motor paralysis. Large doses primarily raise the blood-pressure by stimulating the vasomotor centers and thus constricting the arterioles; secondarily, they lower the blood-pressure by depressing the vasomotor centers and the heart. Hydrastin probably increases peristalsis and induces uterine contractions, although its power to do the latter has been denied by some authorities. Finally, the drug, when locally applied, seems to exert a favorable influence on chronic catarrhal inflammations, but the manner of its action is not understood.

*Hydrastinin* in very large doses is a powerful paralyzant to

the motor centers of the brain and spinal cord. The para
is apparently not preceded, as in the case of hydrastin,
stage of motor excitation. Like hydrastin, it raises the art
pressure, but its action in this respect differs from tha
hydrastin in being more pronounced and more lasting an
not being followed secondarily by circulatory depression.
rise in the arterial pressure is due in part to stimulation o
vasomotor centers, and in part, also, according to some aut
to stimulation of the heart and of the muscular coats o
arterioles. Whether or not hydrastinin can induce ut
contractions is a moot question, but the trend of experim
evidence favors the view that it does possess ecbolic prop
and is capable, in sufficient dose, of causing abortion.

**Therapeutics.**—Hydrastis is a useful local remedy in
tain catarrhal affections. In *leukorrhea*, injections of the
extract, 2 fluidrams (8.0 c.c.) to the pint (0.5 L.) of hot w
are often beneficial. In the catarrhal stage of *gonorrhea*
tions of hydrastinin hydrochlorid, 1–5 gr. (0.06–0.3 gm
the ounce (30.0 c.c.), have been used with excellent results.
same preparation, in doses of from $\frac{1}{12}$–$\frac{1}{6}$ gr. (0.005–0.01 gm
also been highly recommended as an internal remedy in *ch*
*gastric catarrh*, especially when there is muscular atony.

Both hydrastinin and hydrastin have been largely use
ternally as uterine hemostatics. They are particularly
cacious in *menorrhagia* or *metrorrhagia* dependent upon
stitutional disorders, endometritis, or disease of the adne

Hydrastin cannot be used externally owing to its in
bility.

## COTARNINÆ HYDROCHLORID.

(Stypticin.)

Cotarnin is an artificial alkaloid closely allied to hydr
in its chemical composition, and obtained by the oxidat
the opium alkaloid, narcotin. It appears in the form of
crystals of a bitter taste, and freely soluble in water.
dose is from $\frac{1}{2}$–3 gr. (0.3–0.2 gm.), three or four times
It may be administered by the mouth or subcutaneously
action resembles that of hydrastinin, but is less rapid.
been found useful as a hemostatic in *uterine hemorrhag*
accompanied by gross lesion of the uterine mucous mem

## GELATINUM, U. S. P.

(Gelatin.)

Gelatin is the air-dried product of the action of
water on gelatinous animal tissues, such as skin, tendon
ments, and bones. It occurs in brittle, transparent sh
shreds, without odor or taste. It is insoluble in cold

but freely so in hot water, and if the solution contain more than 2 per cent., it solidifies on cooling. Solutions heated above a temperature of 230° F. (110° C.), however, remain permanently liquid.

**Physiologic Action.**—In 1896 Dastre and Floresco demonstrated that blood drawn from a dog into which a 5 per cent. solution of gelatin had been injected intravenously solidified almost immediately, and further that the same result could be secured by adding gelatin to the blood outside of the body. That the solidification was due to clotting and not merely to jellifying was evident from the fact that it occurred at a temperature (38° C.) at which a 5 per cent. solution of gelatin will not jellify, and, moreover, that it occurred also with solutions containing a percentage of gelatin much under that which is necessary for jellying—that is, under 2 per cent. These observers also showed that gelatin could offset the anticoagulant action of peptones, but not of concentrated saline solutions or of substances which decalcify the blood, like oxalic acid. In 1898 Lancereaux and Paulesco found that subcutaneous injections of gelatin were quite as efficient in increasing the coagulability of the blood as intravenous injections. Whether or not its power is affected by digestion has not been definitely determined, although a number of practitioners have attributed good results in hemorrhage to its administration by the mouth or rectum. No satisfactory explanation has yet been offered of the action of gelatin in promoting the coagulability of the blood.

**Therapeutics.**—Carnot appears to have been the first to bring gelatin prominently forward as a hemostatic; although, according to Miwa, it has been used for this purpose for many centuries in Oriental countries. Considerable testimony has already accumulated as to its efficacy in hemorrhages from both external and internal parts. As a local remedy it has been used with success in *epistaxis*, *metrorrhagia*, *bleeding from hemorrhoids*, and in *oozing from wounds*. As an internal hemostatic it has apparently rendered service in *hemoptysis*, *hematuria*, and *enterorrhagia*. It has been found efficacious also in *hemophilia*, *purpura hæmorrhagica*, and *melæna neonatorum*. For bleeding in accessible parts a 10 per cent. solution may be applied on tampons. The solution should be sterilized and should have added to it a small quantity of carbolic acid to prevent decomposition. The dose for subcutaneous administration is from 15–45 gr. (1.0–3.0 gm.), in the form of a 5 or 10 per cent. solution, once or twice a day. The best vehicle is normal salt solution. A 10 per cent. solution may be prepared by dissolving 1½ ounces (50.0 gm.) of gelatin and 35 gr. (2.5 gm.) of

salt in a pint (0.5 L.) of hot distilled water. After the mi has been allowed to cool, the white of an egg should be s in, and the whole brought quickly to the boiling-point. mixture should next be filtered first through gauze and through paper. Finally, it should be poured into small and sterilized in a steam sterilizer, fifteen or twenty mi once daily, for three days. Prepared in this way the mi will keep for several weeks. When required, it shou liquefied by standing the flask in hot water, and then in to the amount of from 3 to 5 fluidrams (10.0–20.0 c.c.) in thigh or under the breast, using for the purpose a pe sterile syringe. When the fluid is free from turbidity, t jections are not painful. It is exceedingly important th solution should be absolutely sterile, since commercial g not infrequently contains tetanus bacilli. Several cas tetanus developing after gelatin injections have recently reported. Acute nephritis is regarded by some authori a contraindication to the employment of gelatin subcutane

When administered by the mouth, it may be given in of from 1–8 dr. (4.0–30.0 gm.) or more daily.

The treatment of *aortic aneurysms* by subcutaneous tions of gelatin, first recommended by Lancereaux, altl it seemed promising, has not proved very satisfactory. followed, however, in a certain proportion of cases by porary amelioration of the symptoms. It is credited witl ing caused embolism in one or two instances.

Gelatin makes a good protective dressing for *indole ulcers*, especially when they are accompanied by c eczema. It may be employed in the form of Unna's dre

℞ Zinci oxidi,
Gelatini, aa ʒj (4.0 gm.);
Glycerini,
Aquæ, aa fʒiv (120.0 c.c.). M

Sig. After the ulcer has been thoroughly cleansed and disi coat the eczematous regions with Lassar's paste (starch oxid, of each, 2 parts; vaselin, 4 parts), dust the ulc iodoform, and cover it with cotton. Then paint the ent with Unna's dressing melted and applied with a brush. age evenly and firmly, first with gauze soaked in hot wat with dry gauze, and finally with a cotton roller bandag dressing should be changed every two, four, or six days, ing to the amount of discharge.

**Incompatibles.**—Tannic acid and formaldehyd.

## CALCII CHLORIDUM, U. S. P., and CALCII LACTAS.

(Calcium Chlorid, $CaCl_2$, and Calcium Lactate, $Ca(C_2H_4OH.COO)_2 + 5H_2O$.)

Calcium chlorid occurs in white, slightly translucent, hard fragments, very deliquescent, odorless, and of a sharp saline taste. It is soluble in 1.3 parts of water and in 8 parts of alcohol. Calcium lactate is a white crystalline powder, not readily soluble in water unless freshly prepared. The dose of either salt is from 5–20 gr. (0.3–1.3 gm.) after meals, well diluted.

**Therapeutics.**—The conclusions of Wright, of Netley, England, that calcium salts possess the power of increasing the coagulability of the blood, have led to their extensive use in the treatment of *hemophilia*, *purpura*, *aortic aneurysm*, and various *internal hemorrhages*, as well as of a number of conditions, such as *urticaria*, *chilblains*, and *certain persistent headaches*, in which blood coagulability is supposed to be defective. Recent observers, however, have failed to confirm Wright's conclusions, and it is very doubtful if calcium can be of benefit in any of the conditions mentioned. Very recently MacCallum and Voegtlin have shown that the intravenous injection of a 5 per cent. solution of calcium lactate causes an almost instant arrest of the tetanoid symptoms occurring after parathyroidectomy, and believe that the drug may have some therapeutic importance, not only in *postoperative tetany* but also in those forms occurring spontaneously.

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# GERMICIDES, ANTISEPTICS, AND DEODORIZERS.

**Germicides** or **disinfectants** are agents that destroy micro-organisms and their spores. They may act by exerting some specific influence on the micro-organisms, by coagulating their albuminous constituents, or by entering into chemical combination with the microprotein. The chief germicides are:

| | |
|---|---|
| Mercuric chlorid. | |
| Phenol (carbolic acid), | |
| Cresols, | |
| Creosol, | |
| Guaiacol, | Aromatic Series. |
| Resorcin, | Benzene derivatives or coal-tar germicides. |
| Naphthalen, | |
| Betanaphthol, | |
| Salicylic acid, | |
| Benzoic acid, | |

Formaldehyd.
Urotropin.
Silver compounds.
Chlorin.
Bromin.
Sulphurous acid.
Hydrogen dioxid.
Potassium permanganate
Lime.

The various preparations of *quinin* also possess a mo amount of germicidal power; they are especially destr to certain protozoa, such as the hematozoa of malaria an amœbæ of dysentery.

**Heat** is the most certain disinfectant. All known patho bacteria and their spores are destroyed by boiling wa from five to ten minutes, and by steam (212° F.—100° ordinary pressure, within an hour. Steam under pressu still more energetic disinfectant. Dry heat, on accou slight penetrating power, is much less effective than heat. According to Koch, sporeless bacteria are destro one and one-half hours by hot air at a temperature s above 212° F. (100° C.), and spores of bacilli in three by hot air at a temperature of 316° F. (140° C.).

**Antiseptics** are agents that prevent or hinder the g of micro-organisms without necessarily destroying Whether a substance act as a germicide or as an ant depends largely upon the degree of concentration in w is employed. By dilution germicides may be reduced rank of antiseptics. The following substances may be c as antiseptics, since in the solutions ordinarily used th rest the development of bacteria, but do not destroy the

Boric acid.
Picric acid.
Ferrous sulphate.

Many volatile oils.
- Eucalyptus.
- Thyme.
- Sandalwood.
- Copaiba.
- Cubeb.

Many anilin derivatives.
- Methyl-blue.
- Methylene-blue.
- Acetanilid.

**Iodoform** (see p. 319), although it is practically w antiseptic power, nevertheless makes a valuable dressing fected wounds. It probably acts indirectly by abs moisture, by liberating iodin, which is antiseptic, and, p by neutralizing the toxins formed by pyogenic bacteria.

**Deodorizers** are agents that destroy offensive odors. They do not, of necessity, possess either germicidal or antiseptic power. They may act by oxidizing or deoxidizing fetid compounds or by abstracting hydrogen from them. The most powerful deodorizers are:

| | |
|---|---|
| Chlorin. | Sulphurous acid. |
| Formaldehyd. | Potassium permanganate. |
| Lime. | Hydrogen dioxid. |

Charcoal.

Pulverized dry earth is a useful deodorant of fecal matter, but it is not to be considered as a disinfectant.

*General Surgical Antisepsis.*—Mercuric chlorid (see p. 327) is the most popular of the germicides for general surgical work. It is energetic, soluble, and cheap. On the other hand, it has three disadvantages: it is very poisonous, it is destructive to metal instruments, and it is readily converted into an inert compound in the presence of albuminous matters. This last drawback may be offset by adding to its solutions a weak acid (tartaric acid). For the patient's skin and the surgeon's hands solutions of from 1:1000 to 1:500 should be employed; for large wounds and cavities, 1:10,000 to 1:5000; and for small wounds, 1:2000. On account of its irritant properties it should not be used on serous membranes.

Carbolic acid is not nearly so reliable as corrosive sublimate, but it is quite destructive to pus-organisms. It is readily soluble, is not affected by albuminous matters, and does not seriously injure metal instruments, although it dulls them. On the other hand, it is decidedly toxic, and it has a benumbing effect on the hands of the operator. A solution of 1:20 is often employed for cleansing suppurating wounds, sinuses, and abscess cavities. A solution of 1:40 is sometimes used as a bath for instruments.

Formaldehyd is a very powerful germicide, but it is too irritating to be generally useful in surgical work. One or 2 per cent. solutions of formalin (40 per cent. solution of the gas in water), however, are sometimes employed to disinfect wounds and to irrigate sinuses and suppurating cavities. Instruments may be disinfected by immersion in a 2 per cent. solution of formalin, or, better, by subjecting them to the action of the gas in a closed chamber (see p. 403).

*Disinfection of the Hands.*—Fürbringer's method, or some modification of it, is usually followed: after removing all dirt from around and beneath the nails, the forearms, hands, and

nails are thoroughly scrubbed with soap and hot water. hands are then soaked for at least a minute in alcohol (95 cent.), and before the alcohol has evaporated they are plu in a hot solution of corrosive sublimate, 1 : 500. Finally, are rinsed in sterile water and dried. The alcohol remove soap and grease from the furrows and pores, and favors penetration of the germicide. Kelly, after scrubbing the h dips them in a warm, saturated solution of potassium per ganate, then in a warm, saturated solution of oxalic acid, finally, in distilled water. Weir's method has been found satisfactory. It is applied as follows: Scrub the hands forearms in running hot water, using a brush and green s clean under and around the nails with a bit of soft w place in the palm a tablespoonful of chlorinated lime an equal quantity of washing soda (not sodium bicarbonate) enough sterile water to make a creamy mass, and rub cream over the hands and forearms until the harsh soda ules can no longer be felt. This rubbing should occupy a five minutes. Push the paste under and around the nail means of a piece of sterile orange-wood, and then wash in sterile water.

*Antisepsis of Mucous Membranes.*—The most important terial poisons for use on mucous membranes are mer chlorid, silver nitrate, organic silver compounds, boric potassium permanganate, and formalin.

*Gastro-intestinal Antisepsis.*—Internally, antiseptics ar service in controlling fermentation and putrefaction in the tents of the stomach and bowel. Of course they cannot re the alimentary canal aseptic, nor can they affect bacteria the typhoid bacillus and the tubercle bacillus, which mul in the intestinal walls. The chief gastro-intestinal antise are carbolic acid, creosote, guaiacol, naphthalin derivat salicylic compounds, sulphites, resorcin, and thymol. S nitrate and the mercurial preparations also owe, no d some of their efficacy in affections of the digestive tract to antiseptic properties.

*Urinary Antiseptics.*—It is quite possible to inhibit growth of micro-organisms in the urine by administering septic agents by the mouth. Urotropin, salicylic compo benzoic acid, and several volatile oils (copaiba, cubeb, sa wood) are used for this purpose.

*Disinfection of Stools and Sputum.*—Stools should be oughly mixed with twice their volume of a 1 per cent. c inated lime solution, of a 5 per cent. carbolic acid solutio of a 2 per cent. formalin solution, allowed to stand for tw three hours, and then buried or discharged into the c

Infected sputum should be received into cups containing a 1 per cent. chlorinated lime solution or a 5 per cent. carbolic acid solution; or the patient may expectorate into moist rags or into impermeable paste-board cups, which should be burnt before the sputum has had time to dry.

*Disinfection of Rooms and their Contents.*—Articles of little value should be burnt. Bedding, clothing, carpets, etc., should be disinfected by steam. Towels, napkins, and sheeting should be soaked in a 5 per cent. carbolic acid solution and then boiled. Woodwork, floors, and plain furniture should be washed with a chlorinated lime solution (1 per cent.) or with a corrosive sublimate solution (1 : 5000). Finally, the room should be fumigated with formaldehyd gas (see p. 403) or with sulphur dioxid (see p. 407), preferably with the former.

## PHENOL, U. S. P.

(Phenol; Carbolic Acid; $C_6H_5OH$.)

Phenol or carbolic acid is obtained from the distillation of coal-tar, and when pure occurs in the form of colorless, needle-shaped crystals of a characteristic odor and of an acrid, burning taste. In the light it acquires a reddish tint, and on exposure to the air it deliquesces. It is soluble in 19.6 parts of water, and freely in alcohol, glycerin, chloroform, ether, and oils. Although it combines with salifiable bases, it is chemically not an acid, but an alcohol of the benzene group. The dose is from ½–2 gr. (0.03–0.13 gm.).

| Preparations. | Dose. |
|---|---|
| Phenol Liquefactum, U. S. P. (86.4 per cent. of absolute phenol and 13.6 per cent. of water) | ½–2 min. (0.03–0.12 c.c.). |
| Unguentum Phenolis, U. S. P. (3 per cent.). | |
| Glyceritum Phenolis, U. S. P. (20 per cent.) | 2–10 min. (0.12–0.6 c.c.). |

**Physiologic Action.**—When applied to the skin, carbolic acid blanches the surface and causes a burning sensation, which is soon followed by numbness. Later the part becomes red and then brown, and the epidermis desquamates. On account of the albuminous coagulum that it forms its caustic action does not extend very deeply into the tissues. Its prolonged application, however, even in dilute solution (5 per cent.), has been followed by gangrene in a number of instances. Absorption readily occurs from cutaneous surfaces, mucous membranes, and wounds.

The heart-beat is first slightly quickened and then slo probably as a result of the direct action of the drug on cardiac muscle.

**Circulatory System.**—In poisoning there is a marked in the blood-pressure from depression of the heart and vasomotor centers.

**Nervous System.**—Toxic doses are quickly followe stupor and coma, the result of cerebral depression. In symptoms referable to the action of the drug on the s cord are rarely noted, but in the lower animals tetanic seiz often develop and are followed by paralysis, indicating tha spinal centers are at first excited and then depressed. Loc the drug acts as an anesthetic by paralyzing the peripl sensory nerve filaments.

**Respiratory System.**—The respirations are first quick and then slowed, in consequence, probably, of the pri stimulation and the secondary paralysis of the respiratory ter. In fatal poisoning death usually results from asphyx

**Temperature.**—Large doses lower the bodily tempera probably through a central action, which results in incre heat-dissipation.

**Elimination.**—Carbolic acid is eliminated by all the em tories, but chiefly by the kidneys. In the tissues a part bines with sulphuric and glycuronic acids, and is eliminat the double sulphate and glycuronate of phenol; a part is dized into hydroquinon and pyrocatechin, which leave body also largely as double sulphates and glycuron When the amount of phenol ingested has been very lar part is excreted unchanged. After large doses the acquires a smoky or greenish-black color, which is due, p ably, to oxidation products of hydroquinon and pyrocate In poisoning ischuria and albuminuria are common sympt

**Action on Lower Organisms.**—Phenol is fatal to pathogenic bacteria, but is not very effective against sp A solution of 1 : 1000 prevents the development of bacteria; a solution of 1 : 100, under favorable condit destroys pyogenic cocci, tubercle bacilli, cholera bacilli, many other non-spore-forming bacteria. Anthrax bacil the spore stage resist the action of a 5 : 100 solution for days. Alcohol and ether as solvents lessen its germi power, and oils practically destroy it. Heat increase destructive action.

**Toxicology.**—Poisoning may result either from the in tion of the drug or from its external application. After ingestion of a very large dose (1 oz.—30.0 c.c.) the u symptoms are unconsciousness, contraction of the pupils,

torous breathing, a rapid, feeble pulse, and collapse. If the dose has not been so large, these symptoms may be preceded by those of gastro-enteritis. The characteristic phenomena are the odor on the breath, the white, corrugated patches on the buccal mucous membrane, and the smoky urine. In poisoning from the use of the acid externally the initial symptoms generally are discoloration of the urine, headache, vertigo, pallor, and muscular weakness.

**Treatment.**—Two drugs are of special value when the poison has been taken by the mouth: Alcohol, which neutralizes its caustic action, and a soluble sulphate (Epsom salt), which forms with it an innocuous sulphocarbolate. Two or three ounces (60.0–90.0 c.c.) of diluted alcohol should be poured into the stomach through a tube, and then lavage practised with water containing Epsom salt. Demulcents are useful in allaying the irritation. The application of external heat and the subcutaneous administration of diffusible stimulants are also indicated.

**Therapeutics.**—As an antiseptic for general surgical purposes carbolic acid no longer holds a prominent place. Solutions that are really effective are too irritant and too toxic to be employed. It is rarely used at present even for disinfecting instruments, because it dulls them and at the same time benumbs the surgeon's fingers. Its prolonged application in the form of a moist dressing, even in weak solution, is dangerous. Harrington has collected 132 cases of gangrene of the fingers or toes from its external application. In most of these cases the strength of solution was less than 5 per cent. A solution of 1 : 20 is still employed to some extent for cleansing *suppurating wounds* and *abscess cavities*. *Carbuncles* are sometimes aborted by injecting into them in the early stage from 5–10 min. (0.3–0.6 c.c.) of a 10 per cent. solution. Excellent results have been obtained in *anthrax* from the injection of from ½–1 dr. (2.0–4.0 gm.) of the pure acid into and around the eschar in the course of a day. Bacelli speaks very favorably of carbolic acid injections in *tetanus*. He recommends that from ⅛–⅜ gr. (0.02–0.04 gm.) should be given hypodermically every two or three hours until a daily amount of from 8–15 gr. (0.5–1.0 gm.) has been reached. Pure carbolic acid is sometimes employed to destroy *chancroids* and *venereal warts* and to purify *sloughing wounds*.

A 5 per cent. solution may be used for disinfecting *soiled clothing* and *various excretions*, like sputum, feces, and vomited matters. In the form of a 2 per cent. spray it may be employed as an inhalation to destroy the fetor of the breath in such affections as *bronchiectasis* and *gangrene of the lung*.

Carbolic is very useful as a local sedative and antipruri Carbolized oil, 10 gr. (0.6 gm.) to the ounce (30.0 c.c.), althou it has no antiseptic power, makes a soothing dressing for *su ficial burns.* In the form of a lotion it is the most valua remedy we possess to allay itching in *eczema, urticaria, ja dice,* and *pruritus.* It may be employed in the strength of fr 2–3 dr. (8.0–12.0 gm.) to the pint (0.5 L.), as in the follow formula:

℞ Phenolis, ʒij–iij (8.0–12.0 gm.);
Acidi borici, ʒiv (15.0 gm.);
Alcoholis, fʒj (30.0 c.c.);
Glycerini, fʒss (15.0 c.c.);
Aquæ, q. s. ad Oj (0.5 L.). M.

Internally, carbolic acid is used as an antiemetic and as antiseptic. Doses of from 1–2 min. (0.06–0.12 c.c.) are so times efficacious in checking *vomiting* the result of gas irritability. In the same doses, combined with bismuth, i of service as an antiseptic in *flatulent dyspepsia* and in *a diarrhea.*

**Administration.**—It may be prescribed in pills, in c sules, in powders of bismuth subnitrate, or dissolved in s aromatic water.

**Incompatibles.**—Alkalis, metallic salts, soluble sulpha collodion.

**Sodium Sulphocarbolate,** or **Sodium Phenolsulp nate** (*Sodii Phenolsulphonas,* U. S. P.).—This salt occurs colorless, rhombic crystals, odorless, of a saline taste, freely soluble in water. The dose is from 5–20 gr. (0.3- gm.). It is much less poisonous than carbolic acid. I sometimes of service as an antiseptic in *flatulent dyspepsia* in *diarrhea.* When intended to act in the stomach, it may prescribed in solution; when intended to act in the intest in keratin-coated pills.

**Zinc Sulphocarbolate,** or **Zinc Phenolsulphon** (*Zinci Phenolsulphonas,* U. S. P.).—This salt is somewhat m astringent than sodium sulphocarbolate. A solution of 5 (0.3 gm.) to the ounce (30.0 c.c.) is sometimes used as a spra *catarrhal affections of the throat* and as an injection in the sec stage of *gonorrhea.* Internally it often acts favorably in *d rhea.* As an intestinal antiseptic the dose is from 2–3 (0.1–0.2 gm.) in keratin-coated pills.

**Sozoiodol** (*Sozoiodolic Acid*).—This compound is p phenol-sulphonic acid with 2 atoms of hydrogen displaced 2 of iodin. Paraphenol-sulphonic acid is prepared by act on phenol with sulphuric acid in the presence of heat. So iodol occurs in needle-shaped crystals, soluble in water and alcohol. It has been used as a substitute for iodoform.

salts—mercury, potassium, sodium, and zinc—have also been employed to some extent as antiseptics.

**Nosophen** (*Tetra-iodo-phenol-phthalein*).—This compound is prepared by the action of iodin on a solution of phenolphthalein. It is a pale, yellow, inodorous, and tasteless powder. With bases it forms salts, the most important of which is the sodium salt (*antinosin*). It is recommended as an antiseptic dusting-powder.

**Xeroform** (*Tribromphenol-bismuth*).—This is a yellowish, odorless, tasteless, and insoluble powder, representing about 50 per cent. of bismuth oxid. It has been used in place of iodoform as an antiseptic application for infected wounds, burns, etc.

## CRESOLS, CREOSOL, AND GUAIACOL.

**Cresols,** of which there are three,—metacresol, orthocresol, and paracresol,—are homologues of phenol. They are obtained from coal-tar by fractional distillation, and are present in large quantity in crude carbolic acid. They closely resemble phenol in their action, and, like the latter, they possess distinct germicidal properties. Their slight solubility in water is an important disadvantage. They are used chiefly for disinfecting specific excreta.

Under the name of *cresol* the U. S. Pharmacopœia recognizes a mixture of the three isomeric cresols obtained from coal-tar, and freed from phenol, hydrocarbons, and water. This preparation is a colorless or straw-colored liquid, having a creasote-like odor, and turning yellowish-brown on exposure to light. It is soluble in 60 parts of water, and miscible in all proportions with alcohol, ether, benzin, and glycerin. Its germicidal power is nearly three times greater than that of carbolic acid. A 1 per cent. solution may be employed in surgical work for the same purposes as carbolic acid. De Schweinitz recommends a 1 : 1000 solution as a solvent for atropin, cocain, and eserin in ophthalmic practice. Such solutions remain free from bacteria and are not irritant to the eye.

**Liquor Cresolis Compositus, U. S. P.**—This is a linseed-oil soap solution of cresol, of 50 per cent. strength. Aqueous mixtures containing from 3 to 5 per cent. of this official solution may be employed with advantage for disinfecting excreta. Mixtures of from 1 to 2 per cent. have been used rather extensively in obstetric practice. Injections containing from 0.5 to 1 per cent. have been found efficacious in chronic cystitis.

**Creolin** is the trade name of an emulsion of cresols prepared by means of rosin soap. It is a brownish, syrupy liquid, which, diluted with water, forms an opaque mixture.

**Lysol** is a cresol preparation made by dissolving in and subsequently saponifying with alcohol that portion tar-oil which boils between 374° and 392° F. (190° and C.). It is a brown, oily liquid, with the odor of creosote contains about 50 per cent. of cresols, and mixes with wat form a clear, saponaceous, frothy liquid. It may be used the same purposes as the compound solution of cresol.

While the cresol preparations are comparatively safe, are not altogether harmless. Poisoning from their absorp has not been very rare. There are at least 20 cases of poi ing by lysol on record.

**Creosol** and **guaiacol** are the chief constituents of sote (see pp. 283 and 286).

## THYMOL, U. S. P.

(Thymic Acid; $C_{10}H_{14}O$.)

Thymol is a homologue of phenol obtained from the o thyme (*Thymus vulgaris*) and certain other volatile oils. appears in the form of large, colorless crystals having the of thyme and an aromatic pungent taste. It is only spari soluble in water, but freely so in alcohol, ether, and oils. dose is from 1–10 gr. (0.06–0.6 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Liquor Antisepticus, U. S. P. (contains 0.1 per cent. of thymol) . . . . . | ½–2 fl. dr. (2.0–8.0 c.c |

**Physiologic Action and Therapeutics.**—Thymol sembles carbolic acid in its action, although it is decidedly toxic and less irritant. It has been used as an antiseptic in dressing of *wounds*, but its aromatic odor soon becomes agreeable to the patient, and, moreover, is apt to attract A solution of a grain (0.06 gm.) to the ounce of water ( c.c.), a little alcohol being used as a solvent, makes a g mouth-wash in the infectious forms of *stomatitis* and *pha gitis*. An ointment of thymol, 5–30 gr. (0.3–2.0 gm.) to ounce (30.0 gm.), has been used with some success by Cro and others in chronic *eczema* and *psoriasis*. The drug ma an excellent lotion in *senile pruritus*.

Internally, thymol is sometimes used as an antiseptic in *acute diarrhea*. In doses of 30 grains (2.0 gm.) for adults 8–15 grains (0.5–1.0 gm.) for children, repeated in two ho it is the best remedy known for *uncinariasis* or hook-w disease. It has also been used to some extent as a vermif against the *tapeworm* and *lumbricoid worm*. Thymol r be administered in wafers, capsules, or pills.

**Thymolis Iodidum, U. S. P.**—This compound, whic also known as *aristol*, is chemically dithymol-diodid. I

prepared by acting upon thymol in alkaline solution with iodin dissolved in potassium iodid. It is an unstable preparation, containing about 45 per cent. of iodin, and appears as a brownish-red powder, tasteless and almost odorless. It is employed as a substitute for iodoform. Although it has advantages over the latter in being odorless and less toxic, it is generally not so efficacious.

## RESORCINOL, U. S. P.

(Resorcin; Metadioxybenzol; $C_6H_4(OH)_2$.)

Resorcin is a diatomic phenol, occurring in the form of colorless or faintly reddish prisms or needles having a slightly urinous odor and a sweetish, pungent taste. It is readily soluble in water, alcohol, ether, or glycerin. The dose is from 1–5 gr. (0.06–0.3 gm.).

**Physiologic Action and Therapeutics.**—Resorcin acts much like carbolic acid, but it is less poisonous and less irritant. Toxic doses produce vertigo, ringing in the ears, tremors, epileptiform convulsions, quickening of the pulse and respiration, unconsciousness, and collapse. The urine becomes of an olive-green color. In health it exerts but little effect on the temperature, but in the febrile state it causes a marked fall, which is accompanied by free perspiration.

At the present time resorcin is chiefly employed externally except in certain diseases of the skin. It is a valuable remedy in *seborrhea*, especially in dandruff, in which disease it may be employed in the form of a 3 to 5 per cent. lotion, as in the following formula:

℞ Resorcinolis, ʒiss (6.0 gm.);
Olei ricini, ♏xx–xxx (1.2–2.0 c.c.);
Spiritus myrciæ, q. s. ad f℥iv (120.0 c.c.). M.

A lotion containing from 5 to 20 gr. (0.3–1.3 gm.) to the ounce (30.0 c.c.) is often serviceable in *subacute* and *chronic eczema*, especially of the vesicular variety. It is also a useful antipruritic remedy. According to Hartzell, its power to relieve itching is increased considerably by the addition of 0.5 per cent. of sodium chlorid to the solution, as in the following formula:

℞ Resorcinolis, gr. xv–xxx (1.0–2.0 gm.);
Sodii chloridi, gr. xv (1.0 gm.);
Glycerini, f℥ij (8.0 c.c.);
Liquoris calcis, q. s. ad f℥iv (120.0 c.c.). M.

Internally, resorcin is occasionally used as an antiseptic in *chronic diseases of the stomach* and in *diarrhea*. It should be given in pill or capsule.

## ACIDUM PICRICUM.

(Picric Acid; Carbazotic Acid; Trinitrophenol; $C_6H_2(NO_2)_3.OH.$)

Picric acid is the product of the action of nitric acid phenol-sulphonic acid, which is obtained by dissolving crys lized carbolic acid in sulphuric acid. It occurs in yellow, crystals, odorless, and of an intensely bitter taste. It is s ingly soluble in water, but freely so in alcohol and in et

**Physiologic Action and Therapeutics.**—Locally, ric acid in pure form acts as a caustic. Poisonous doses duce vomiting, diarrhea, yellowness of the skin, mucous m branes, and urine, convulsions, and collapse. It is a fe bactericide.

Gauze wet with a 1 per cent. solution of picric acid, ered with cotton, makes an excellent dressing for *burn* the first and second degree. For fear of poisoning, h ever, the drug should not be applied over large or burns. A 1 per cent. lotion has also been found service in *acute eczema* and in *herpes zoster*. Occasionally local a cations are followed by an erythematous rash. Injection picric acid, 1 : 200 to 1 : 100, are recommended by some geons in the treatment of the second stage of *gonorrhea*. saturated solution makes a delicate test for albumin in the u

Internally, ammonium picrate was used for a time a antimalarial and anthelmintic, but it soon proved unsuitabl either purpose.

## NAPHTHALENUM, U. S. P.

(Naphthalen; Naphthalin; Tar Camphor; $C_{10}H_8.$)

Naphthalen is a hydrocarbon obtained by distilling coa between 180°–250° C. (356°–482° F.). It occurs in w shining scales, having a strong odor of coal-tar and a bur taste. It is insoluble in water, soluble in 13 parts of alc and in all proportions in ether and chloroform. The do from 2–10 gr. (0.13–0.6 gm.).

**Therapeutics.**—Naphthalen was at one time used a intestinal antiseptic in *diarrhea*, but it has been almost pletely displaced by betanaphthol.

### BETANAPHTHOL, U. S. P.

(Betanaphtol; $C_{10}H_7OH.$)

Betanaphthol is a phenol occurring in coal-tar, but us prepared artificially from naphthalen. It occurs in w shining scales or as a yellowish-white crystalline powder, ha a faint, phenol-like odor and a pungent taste. It is solub

about 950 parts of water, and freely soluble in alcohol, ether, and chloroform. The dose is from 2–10 gr. (0.13–0.6 gm.).

**Physiologic Action and Therapeutics.**—Betanaphthol resembles carbolic acid in its action, but it is less poisonous. Large doses, however, not infrequently give rise to considerable irritation of the genito-urinary tract. It is eliminated in the urine in combination with glycuronic acid. Locally, in concentrated form, it is irritating to mucous membranes and raw surfaces. Absorption readily follows its local application. Its germicidal power is much greater than that of carbolic acid.

Internally, betanaphthol is useful as an antiseptic in *chronic diseases of the stomach* and in *diarrhea*. Bouchard and others have recommended it also in *typhoid fever;* the course of the disease, however, is not affected in the least by it, although it is sometimes of service in lessening flatulence and diarrhea. In doses of 15 grains (1.0 gm.), repeated in two hours, it has been used successfully in *uncinariasis* or *hook-worm disease*. It is best administered in capsules.

Externally, it is efficacious as a parasiticide and stimulant application in certain diseases of the skin. In *scabies* and in *ringworm of the scalp or body* it may be employed as an ointment in the strength of a dram (4.0 gm.) to the ounce (30.0 gm.). Ointments containing from ½–1 dr. (2.0–4.0 gm.) to the ounce (30.0 gm.) have been used also with some benefit in psoriasis, but, as a rule, the drug is less useful in this disease than either chrysarobin or tar.

**Benzonaphthol.**—This compound is prepared by acting on betanaphthol with benzoyl chlorid. It is said to escape the action of the gastric juice, and to be split up into its components in the intestine. In doses of from 5–10 gr. (0.3–0.6 gm.) it is a good intestinal antiseptic, having at least one advantage over betanaphthol in being tasteless.

**Betanaphthol-bismuth** (*Orphol*).—This preparation is a combination of bismuth oxid and betanaphthol. It is a light-brown, insoluble powder, odorless and tasteless. As its decomposition is mainly effected after it leaves the stomach, it is found efficacious in the various forms of intestinal catarrh. The dose is from 10–30 gr. (0.6–2.0 gm.).

## ACIDUM SALICYLICUM, U. S. P.

(Salicylic Acid; $HC_7H_5O_3$.)

Salicylic acid is an organic acid contained in wintergreen, birch, and various other plants, but chiefly prepared artificially by acting on phenol with caustic soda and carbon dioxid. It occurs in fine white needles or as a crystalline powder, odorless, and of a sweetish, acrid taste. It is soluble in 308 parts

of water, 2 parts of alcohol, 2 parts of ether, and 60 part glycerin. The dose is from 5–20 gr. (0.3–1.3 gm.).

**Physiologic Action.**—Single, moderate doses of sali acid are not followed, as a rule, by any appreciable sympt Large doses, or even moderate doses in susceptible subj however, give rise to a feeling of fulness in the head and ing in the ears, and, perhaps, to deafness, dimness of vi flushing of the surface, and perspiration. Toxic doses, in a tion to the above symptoms, produce labored breathing lowed by shallow respiration, subnormal temperature, a s feeble pulse, olive-green urine, albuminuria, delirium, o palsies, unconsciousness, paralysis of the sphincters, and lapse. Death usually results from asphyxia. In some the delirium has been associated with delusions and hallu tions; in others, there has been an erythematous, urtic or ecchymotic eruption.

**Circulatory System.**—Moderate doses slightly raise blood-pressure, probably by constricting the deep ve through a central action. The superficial vessels are dil Large doses lower the blood-pressure by depressing the and vasomotor center. The administration of salicylic results in a moderate leukocytosis. In poisoning, the red suffer disintegration.

**Nervous System.**—Salicylic acid has comparatively influence on the nervous system. The fulness in the hea the disorders of hearing are probably the result of som turbance of the circulation; the amblyopia has been attri to the same cause, but there is a suspicion that it is proc by changes in the ganglion-cells of the macula.

**Respiratory System.**—Toxic doses appear first to stim and then to paralyze the respiratory center.

**Alimentary Canal.**—Its presence in the alimentary even in small quantities, tends to retard the action of the tive ferments. It is a distinct irritant to the mucous mem of the stomach, and, in consequence, nausea and vomitin frequently induced by its administration. It appears to some power to increase the secretion of bile.

**Metabolism.**—There is considerable testimony to show salicylic acid increases the output of urea, uric acid, an sulphur compounds, but how this is brought about ha been determined.

**Temperature.**—In health salicylic compounds do not much influence on the bodily temperature; in fever, how they have a marked antipyretic effect, which probably r from dilatation of the cutaneous vessels and an increase of heat.

**Absorption and Elimination.**—Salicylic acid enters the blood as an alkaline salicylate. It is eliminated from the body in most of the secretions, but chiefly in the urine, in which it appears for the most part as salicyluric acid, a compound of salicylic acid and glycocoll, although some of the drug is excreted unchanged. The greenish discoloration of the urine is said to be due to the formation of indican or of pyrocatechin. Its excretion is attended by some increase in the flow of urine, owing, no doubt, to stimulation of the kidneys. Large doses may excite nephritis.

**Action on Micro-organisms.**—Its germicidal properties are no less pronounced than those of carbolic acid.

**Therapeutics.**—The chief use of salicylic acid and its allied compounds is in *acute rheumatism*, on which disease they exert a specific influence, mitigating the pain, lowering the temperature, lessening the liability to cardiac complications, and shortening the duration of the attack. The manner in which these drugs produce their favorable influence is not understood, but it is possible that they may act by neutralizing the toxins of the infective agent. From 10 to 15 gr. (0.6–1.0 gm.) of the acid or of one of its salts should be given every two or three hours until tinnitus develops or the articular symptoms are favorably affected, when the interval between the doses may be gradually increased. Salicylic compounds are also efficacious in certain affections which seem to be in some way related to rheumatism, such as *tonsillitis*, *chorea*, *lumbago*, *sciatica*, *erythema nodosum*, and *neuritis* due to cold. In chronic rheumatism they are of little value, and in rheumatoid arthritis and gout they are useless.

In *diabetes mellitus*, for which they were originally recommended by Ebstein, they are frequently of service in lessening the excretion of urine and in relieving pruritus.

Salicylic acid is no longer in use as a topical antiseptic, but some of the less soluble combinations of it are employed with advantage in checking *fermentation in the intestinal canal.*

Locally, the acid is an excellent remedy in certain diseases of the skin. The following dusting-powder often affords relief in *hyperidrosis*:

℞ Acidi salicylici, gr. xxx (2.0 gm.);
Acidi borici, ʒj (4.0 gm.);
Amyli, ʒss (15.0 gm.). M.

Ointments or pastes containing from 20–40 gr. (1.3–2.6 gm.) to the ounce (30.0 gm.) are of service in many cases of *subacute* and *chronic eczema.* Dissolved in collodion, a dram (4.0 gm.)

to the ounce (30.0 c.c.), it is employed with success in r
ing *corns* and *warts*.

**Contraindications.**—Salicylic compounds must be
held or used with great care when there is renal irritati
active disease of the middle ear.

**Administration.**—Salicylic acid is more irritating
stomach than its salts, and for this reason the latter are
ally selected for internal use. The acid obtained from
wintergreen has no advantage over the cheaper synthet
if the latter be of official quality. Salicylic compounds s
be given after meals, in some aromatic water, well d
When in rheumatism they are not tolerated in any fo
the stomach, the acid may be applied directly to the joi
in the following formula:

℞ Acidi salicylici, ʒiss (6.0 gm.);
Olei terebinthinæ, f ʒj (4.0 c.c.);
Adipis lanæ hydrosi, ℥ss (15.0 gm.);
Adipis benzoinati, q. s. ad ℥ij (60.0 gm.). M.
Sig. Spread on muslin and keep in place by means of
bandage.

### SODII SALICYLAS, U. S. P.

(Sodium Salicylate; $NaC_7H_5O_3$.)

Sodium salicylate is a white amorphous powder, oc
and of a sweetish, saline taste. It is soluble in 0.8 p
water and in 6 parts of alcohol. The dose is from 5-
(0.3–1.3 gm.).

**Therapeutics.**—It is the most commonly used of
salts of salicylic acid. Its action is the same as that
acid, but it has advantages in being more soluble in wa
less irritant to the stomach. Like all salicylic comp
however, it should be given after meals, well dilute
rheumatism it may be combined advantageously with an
as in the following formula:

℞ Sodii salicylatis,
Potassii bicarbonatis, āā ʒss (15.0 gm.);
Aquæ menthæ piperitæ, q. s. ad f ʒiv (115.0 c.c.).
Sig. A dessertspoonful in water four times a day.

### LITHII SALICYLAS, U. S. P.

(Lithium Salicylate; $LiC_7H_5O_3$.)

Lithium salicylate is a white, deliquescent powde
sweetish taste. It is freely soluble in water and in alco
is somewhat less irritating to the stomach than sodium
late, for which it may be substituted. The dose is fro
gr. (0.3–1.3 gm.).

### AMMONII SALICYLAS, U. S. P.

(Ammonium Salicylate; $NH_4C_7H_5O_3$.)

Ammonium salicylate occurs in clear, colorless prisms, freely soluble in water. Wood recommends it as being more agreeable to the taste and less depressing and less nauseating than the sodium salt. The dose is from 5–20 gr. (0.3–1.3 gm.).

### STRONTII SALICYLAS, U. S. P.

(Strontium Salicylate; $Sr(C_7H_5O_3)_2$.)

Strontium salicylate occurs in colorless octahedral crystals, freely soluble in water. It is much less irritating to the stomach than the sodium salt. The dose is from 5–20 gr. (0.3–1.3 gm.).

### METHYLIS SALICYLAS, U. S. P.

(Methyl Salicylate; Artificial Oil of Wintergreen; $CH_3C_7H_5O_3$.)

Methyl salicylate is prepared synthetically by distilling methyl alcohol with salicylic and sulphuric acids. It is a colorless or slightly yellowish oily liquid, having the characteristic odor and taste of wintergreen. It appears to be almost identical in its properties and actions with the natural oil of wintergreen (*Oleum Gaultheriæ*, U. S. P.) and the oil of sweet birch (*Oleum Betulæ*, U. S. P.), which are composed almost entirely of pure methyl salicylate. The dose of either the artificial product or of the natural oils is from 5–20 min. (0.3–1.2 c.c.).

**Therapeutics.**—These preparations may be used internally in *rheumatism* interchangeably with salicylic acid and the mineral salicylates. They are more likely, however, to disturb digestion than either ammonium or strontium salicylate, and, moreover, their strong flavor often turns the patients against them. Externally, they serve an excellent purpose as local applications to the affected joints. For internal use they may be given on sugar, in capsules, or in an emulsion. As a local remedy methyl salicylate is as efficient as oil of wintergreen, and very much cheaper.

**Mesotan.**—This is the trade name of the methyl oxymethyl of salicylic acid. It is a yellow liquid, miscible with oils and other organ solvents. Diluted with from 20 to 30 per cent. of some bland oil, it has been recommended as a local remedy in rheumatic affections. Though more irritating, it does not appear to be any more effective than methyl salicylate or oil of gaultheria. Moreover, it is costly.

### BISMUTHI SUBSALICYLAS, U. S. P.

(Bismuth Subsalicylate; $Bi(C_7H_5O_3)_3Bi_2O_3$.)

Bismuth subsalicylate is a white, odorless, tasteless, and in-

soluble powder, containing about 62 per cent. of bismu oxid. It is used almost entirely as an intestinal antisept astringent in *diarrhea*. The dose is from 5–20 gr. (0 gm.).

### PHENYLIS SALICYLAS, U. S. P.

(Phenyl Salicylate; Salol; $C_6H_5C_7H_5O_3$.)

**Salol is a white crystalline powder, of a faintly ar** odor, and almost tasteless. It is nearly insoluble in wat soluble in 5 parts of alcohol, 0.3 part of ether, and rea oils. The dose is from 5–20 gr. (0.3–1.3 gm.).

**Physiologic Action and Therapeutics.**—Salol to a great extent the action of the gastric juice, but is broken up by the alkaline fluids of the intestine into sa acid (60 parts) and carbolic acid (40 parts). After very doses poisoning results from carbolic rather than from sa acid.

Like other salicylic compounds, it is useful in the v manifestations of *rheumatism*, but in the more severe fo the disease its action is less prompt and powerful than t sodium or ammonium salicylate. As its dissociation do occur until it has escaped from the stomach, it may b ployed advantageously as an antiseptic in all forms of *int catarrh* associated with abnormal fermentation. In *cysti urethritis* it is often combined with such drugs as oil of s wood and balsam of copaiba for the purpose of sterilizi urine.

It should always be used with considerable caution there is evidence of active nephritis.

It may be prescribed in powders, capsules, pills, o emulsion. Tablets and hard pills may fail of solutio escape in the feces.

**Aspirin or Acetylsalicylic Acid.**—This compou fers from salol in possessing an acetyl instead of a radical. It is a white crystalline powder having an aci taste, soluble in 100 parts of water and in 5 parts of a It passes unchanged through the stomach, but undergo sociation in the alkaline fluids of the duodenum, lib salicylic acid. It acts like the latter, but being split up it is less irritant and less prone to cause unpleasant side e at the same time its action is less prompt and less po than that of the free acid. It is incompatible with alkali their carbonates and bicarbonates. It cakes with ant Heat and moisture also decompose it. The dose is fro gr. (0.3–1.0 gm.) in capsules, cachets, or powders.

**Salophen** (*Acetyl-paramido-phenyl Salicylate*).—This is a compound ether of salicylic acid, occurring in tasteless and inodorous white scales, insoluble in water, but soluble in alcohol and ether. It contains about 50 per cent. of salicylic acid. It was introduced as a substitute for salol, on account of the ill effects thought to result from the liberation of phenol from the latter. It is decomposed in the intestine into salicylic acid and the comparatively innocuous acetyl-paramido-phenyl. It is much less active in *rheumatism* than sodium salicylate, but being tasteless and unirritating to the stomach, it is a valuable remedy in the *milder manifestations of the disease*. The dose of salophen is from 5–30 gr. (0.3–2.0 gm.).

**Betol** differs from salol in containing a naphtyl instead of a phenyl group. It is decomposed in the intestine into beta-naphthol and salicylic acid. It is used in the same doses and for the same purposes as salol.

### SALICINUM, U. S. P.

(Salicin; $C_{13}H_{18}O_7$.)

Salicin is a glucoside obtained from several species of willow (*salix*) and poplar (*populus*). It occurs in white, silky needles, odorless, and of a very bitter taste. It is soluble in 21 parts of water and in 71 of alcohol. The dose is from 10–40 gr. (0.6–2.6 gm.). Salicin was the first of the salicylic preparations to be used in rheumatism, Maclagen, of Dundee, having prescribed it in 1874, a year before the introduction of salicylic acid by Buss, of Basle. It is partially converted in the body into salicylic acid, and rapidly appears in the urine partly as salicin and partly as saligenin, salicyluric acid, and salicylic acid. It is well borne by the stomach, but it is far less active and reliable than salicylic acid or the salicylates.

## ACIDUM BENZOICUM, U. S. P.

(Benzoic Acid; $HC_7H_5O_2$.)

Benzoic acid (see p. 277) is an organic acid contained largely in benzoin, balsam of Peru, and balsam of tolu. It is obtained from benzoin, from the urine of herbivorous animals, and artificially from toluene, a coal-tar derivative. It occurs in white or slightly yellow scales or needles, of an aromatic odor and taste. It is sparingly soluble in water, but freely so in alcohol, ether, and chloroform. The dose is from 5–20 gr. (0.3–1.3 gm.).

**Therapeutics.**—The germicidal power of benzoic acid is about equal to that of salicylic acid. Internally, it is very use-

ful as a urinary antiseptic in *cystitis with ammoniacal* The acid itself and its salts have also been employed to extent as intestinal antiseptics in *catarrhal enteritis.* S and others have recommended the benzoates in *rheum* but they have been found much less efficacious than the lates.

Externally, in the form of balsam of Peru (see p. 279 zoic acid is much used as a parasiticide in *scabies.*

## FORMALDEHYDUM.

(Formaldehyd; Formic aldehyd; Oxymethylene; $CH_2O$.)

Formaldehyd is a colorless gas obtained by ox methyl alcohol (wood-alcohol). A 37 per cent. aqueou tion of the gas is official as *Liquor Formaldehydi.* The is a clear, colorless, neutral liquid, of a very pungent od a caustic taste. Other preparations of the same natu variously known as *formalin, formal, methylaldehyd,* e solution the gas readily polymerizes, forming *paraforma* or *paraform* (trioxymethylene, ($CH_2O_3$)), a white cry powder, which yields formaldehyd on heating.

**Physiologic Action and Therapeutics.**—Forma is an intensely irritating gas, causing, when inhaled, seve gestion and even inflammation of the mucous membran entire respiratory tract. On cutaneous surfaces conce solutions or even dilute solutions if the contact be pro not infrequently excite an erythematous or eczematou tion. Concentrated solutions coagulate albuminous r but weak solutions do not. To higher animals it is co tively harmless, but prolonged inhalation may caus pneumonitis. In a case cited by Zorn, an ounce (30.0 formalin produced the following symptoms: burning throat and stomach, nausea, vomiting, diarrhea, a weak pulse, dyspnea, cyanosis, vertigo, and anuria lasting for hours. The urine passed later contained albumin an Large doses, as in Klüber's case, may cause also stup coma. The antidote for formaldehyd poisoning is amm the form of the water or spirit, which combines with dehyd to form the harmless hexamethylenamin (uro The fate of formaldehyd in the body is not definitely but a portion at least appears to be eliminated in th unchanged.

**Germicidal Power.**—The germicidal power of forma is little, if at all, inferior to that of mercuric chlorid. A cent. solution of the official preparation kills pure cultu

pathogenic bacteria in an hour, and, according to Harrington, bacteria of the highest resistance, when freely exposed to an atmosphere produced by vaporizing 110 c.c. of liquor formaldehydi in each 1000 cubic feet, are killed within two and a half hours. Though very diffusible, formaldehyd has little penetrating power; it cannot be considered, therefore, except under the most favorable conditions, more than a surface disinfectant. As it unites readily with hydrogen sulphid, mercaptan, ammonia, and fetid ammonia bases to form inodorous compounds, it is a powerful deodorizer.

As a *surface disinfectant for rooms* it has decided advantages in being comparatively harmless to the higher forms of animal life, and in having no injurious effects on delicate fabrics or metals. On account of its weak penetrating power, however, it is not a suitable disinfectant for upholstered furniture, carpets, bedding, books, etc. As the aqueous solution when vaporized from an open vessel loses most of its germicidal power through the polymerization of the formaldehyd into paraform, some special device has been found necessary for securing an adequate supply of the gas. Lamps devised for generating formaldehyd directly from methyl alcohol were first employed, but they did not prove reliable. A sufficient quantity of gas may be obtained by vaporizing paraform tablets in a suitable lamp, or by subjecting a fine stream of the aqueous solution by means of a special contrivance to a high degree of heat. If the paraform lamp be used, it must be placed inside the room to be disinfected; but if the second form of apparatus be employed, it may be placed outside, the gas being conducted into the room by means of a tube passed through the keyhole. At least 60 paraform tablets or a quart (1.0 L.) of the official solution should be vaporized for every 1000 cubic feet of room to be disinfected. Another simple but very reliable method is to add formalin to powdered potassium permanganate. The mixture should be made in a galvanized iron pail that has been slightly heated beforehand, and 20 ounces (570.0 c.c.) of formalin and 8½ ounces (245.0 c.c.) of the permaganate should be used for every 1000 cubic feet of room space requiring disinfection. To secure the best results with any of these methods the room should be sealed as hermetically as possible before the operation, and should be kept closed after it for at least ten hours. Subsequently ammonia water may be evaporated in the room to destroy the formaldehyd.

An excellent method of sterilizing *small instruments* without dulling or tarnishing them is to expose them for ten minutes

in an air-tight tin box to the vapor evolved from a 5 gr. gm.) paraform tablet.

A 5 per cent. solution of the official preparation (1 : 20 p of water) in excess is a reliable disinfectant for *stools* and *sp*

The irritant properties of formaldehyd detract from its fulness in general surgical work, but a 1 or 2 per cent. solu of liquor formaldehydi may be employed to cleanse *wo* and to irrigate *sinuses* and *suppurating cavities.* A solutio the same strength containing glycerin makes a useful *wash the nose and throat* in infectious diseases. Solutions of 1 : 1000 to 1 : 500 have been found serviceable in *chronic rhea.* A solution of 1 : 2000 has been used successfully collyrium, especially in *ulcerative keratitis.* A lotion con ing from 2 to 4 per cent. of liquor formaldehydi is someti very efficacious in *bromidrosis* and *hyperidrosis.*

There is considerable evidence to show that formalde added to milk as a preservative lessens its nutritive value interferes with digestion; it is but fair to state, however, Tunnicliffe and Rosenheim conclude from a recent stud the subject that in the proportion ordinarily used the drug no appreciable influence on perfectly healthy children.

**Incompatibles.**—Ammonia, alkalis, gelatin, tannin, mineral salts.

**Glutol.**—This is a combination of formaldehyd and ge appearing as a gray, odorless, and tasteless powder. It been well spoken of as a substitute for iodoform in the t ment of *infected wounds* and *ulcers.*

**Tannoform** (see p. 357) is a combination of formalde and tannic acid. It is chiefly useful as a dusting-powde *hyperidrosis.*

## HEXAMETHYLENAMINA, U. S. P.

(Hexamethylenamin; Urotropin; $(CH_2)_6N_4$.)

Hexamethylenamin, or urotropin, is the product of the a of formaldehyd on ammonia. It occurs in colorless rho crystals, odorless, and of a sweetish taste. It is soluble i parts of water, less soluble in alcohol, and insoluble in e It is readily decomposed by acids and by heat. The do from 3–10 gr. (0.2–0.6 gm.), dissolved in water, thrice between meals.

**Physiologic Action and Therapeutics.**—When t internally in moderate doses, urotropin produces no sp symptoms, but is rapidly absorbed and rapidly elimina partly unchanged and partly as formaldehyd. The bulk

escapes in the urine, but, according to Crowe, after large doses enough appears in the bile and cerebrospinal fluid to exercise a decided bactericidal action. Urine passed shortly after the administration of urotropin remains sterile for a long period, even when exposed to the air. It does not materially increase the quantity of urine nor affect the elimination of solids, but it has more power than any other internal remedy of ridding that secretion of bacteria. Large doses, especially if long continued, sometimes cause frequent micturition, burning in the bladder, and even hematuria; but these symptoms speedily disappear upon the withdrawal of the drug. As a urinary antiseptic urotropin is most efficacious in *typhoid cystitis*, in *chronic cystitis* accompanying *prostatic enlargement* or *urethral stricture*, and in *simple bacteriuria*. Its power to arrest ammoniacal decomposition of the urine is sometimes truly remarkable. To secure a lasting effect, however, it should be given for a considerable period after the urine has become apparently sterile. If the urine be alkaline when secreted by the kidneys, formaldehyd may not be liberated; in such cases urotropin, to be effectual, should be preceded by a course of benzoic acid.

When bacteria, instead of being free in the urine, are chiefly in the tissues of the bladder, as they are in tuberculous and gonorrheal cystitis, urotropin is of little value.

As the urine of typhoid patients frequently contains typhoid bacilli long after the establishment of convalescence, and as this secretion is frequently the means, no doubt, of spreading the infection, Horton-Smith, Richardson, Gwyn, and others have advocated as a routine prophylactic measure the administration of urotropin during the last weeks of the disease.

Keyes, Otis, and others have found the drug of value as a prophylactic remedy in preventing infection when administered for several days before and several days after *operations on the genito-urinary tract*. It is important, however, that it should not be used too freely, since when eliminated in large quantities it tends to retard healing.

Crowe believes that urotropin may be of great value both in preventing and in combating *infection of the gall-bladder and of the cerebrospinal meninges*.

## CHLORUM.

(Chlorin; Cl.)

Chlorin is a heavy, yellowish-green gas, of a suffo odor and a caustic taste. It may be prepared by heati gether sodium chlorid, sulphuric acid, and manganese or by acting upon chlorinated lime with an acid.

| Preparation. | Dose. |
|---|---|
| Liquor Chlori Compositus, U. S. P. (contains at least 0.4 per cent. of the gas with some oxides of chlorin and potassium chlorid) . . | 1–2 fl. dr. (4.0–8.0 |

**Physiologic Action and Therapeutics.**—In c trated form chlorin acts as a powerful irritant, even upo neous surfaces. When inhaled it excites pain in the cough, dyspnea, spasm of the vocal cords, and, ulti mucopurulent or fibrinous bronchitis with inflammati edema of the lungs. Owing to its affinity for hydrog its power to separate nascent oxygen from water, it is a getic germicide, especially in the presence of moisture the same reasons it is also an active deodorizer.

As a gaseous disinfectant for rooms, however, it has disadvantages in being exceedingly irritant and poison being destructive to wall-paper and other colored fabri in being so heavy that it diffuses with difficulty. Th pound solution of chlorin (chlorin water) is a very u preparation; for disinfecting excreta it is, therefore, le able than chlorinated lime. Largely diluted, it has be to some extent as a wash for *fetid sores* and as a *spray nose and throat* in infectious diseases. Internally, it h recommended as an intestinal antiseptic in *typhoid feve* is of very doubtful utility.

### CALX CHLORINATA, U. S. P.

(Chlorinated Lime.)

Chlorinated lime is a preparation containing not less per cent. of available chlorin, and is obtained by ac slaked lime with chlorin gas. It consists chiefly of th chlorite and the chlorid of calcium, and appears as a white powder, having a strong odor of chlorin and a d able saline taste. It is partially soluble in water alcohol.

**Action and Uses.**—A solution of 0.5–1 per cent. o prepared chlorinated lime kills most bacteria within t utes. A 0.5 per cent. solution makes a reliable disi

wash for *bare walls* and *woodwork*. A solution of the same strength is also useful for disinfecting *white clothes*. A 1 per cent. solution may be employed to sterilize *feces and sputa*.

**Liquor Sodæ Chlorinatæ, U. S. P.** (Solution of Chlorinated Soda, or Labarraque's Solution).—This is a solution of several chlorin compounds of sodium containing at least 2.4 per cent. of available chlorin. It is used for the same purposes as chlorinated lime.

## ACIDUM SULPHUROSUM, U. S. P.

(Sulphurous Acid; $H_2SO_3$.)

Sulphurous acid gas, or sulphur dioxid ($SO_2$), when required in large amounts, is usually obtained by burning sulphur. In the official preparation, however, which is a 6 per cent. aqueous solution of sulphur dioxid, the gas is obtained by reducing sulphuric acid with charcoal.

**Physiologic Action and Therapeutics.**—Sulphur dioxid is an intensely irritating, suffocating gas, quite capable, if inhaled in sufficient quantity, of destroying life. It has considerable germicidal power, especially in the presence of moisture, and before the introduction of formaldehyd it was the most popular gaseous disinfectant for rooms, hospital wards, and ships. Formaldehyd, however, being much more reliable and being without injurious effects on colored fabrics, has largely displaced it. To be at all effective, at least 4 pounds of sulphur should be burned for every 1000 cubic feet of airspace in the apartment. The sulphur, in the form of small fragments, should be put in a pan, and the latter should be placed inside of a tub partly filled with water. Before being ignited the fragments should be well saturated with alcohol. To secure the required amount of moisture steam may be generated at the same time or the walls and contents of the room may be previously sprayed with water. Key-holes and other openings should be carefully sealed, and the gas should be allowed to act for from ten to twelve hours.

A more convenient method of sulphurous acid disinfection, but one not always available, is to use the gas that has been liquefied under pressure and has been stored in metal cylinders.

Official sulphurous acid, though somewhat irritant, is a reliable parasiticide in *ringworm of the body*. It may be applied in full strength or diluted. As light and air gradually convert sulphurous into sulphuric acid, only fresh preparations should be employed.

## AQUA HYDROGENII DIOXIDI, U. S. P.

(Solution of Hydrogen Dioxid; Solution of Hydrogen Peroxid.)

Hydrogen dioxid ($H_2O_2$) is a very unstable compound pared by the action of mineral acids or barium dioxid. employed in medicine only in the form of aqueous solu The official solution, when freshly prepared, contains abo per cent., by weight, of the pure dioxid, an amount corresp ing to about 10 volumes of available oxygen. This sol is a colorless liquid, odorless, of a slightly acidulous taste producing a foam in the mouth. It contains a small am of free acid as a preservative. Sunlight, protracted agita heat, and many metallic substances serve to decompose it oxygen and water.

**Physiologic Action and Therapeutics.**—The thera tic value of hydrogen dioxid depends upon the readiness which it parts with oxygen when it is brought in contact the tissues and fluids of the body. When it is applied suppurating wound, effervescence follows from the liber of oxygen, the pus is discharged, and the surface is left fectly clean and protected by a delicate coagulum. W taken internally it causes no special symptoms, its decom tion into oxygen and water being speedily effected in stomach. According to Egbert, it has no inhibitive influ on the unorganized ferments, such as ptyalin and pe When injected intravenously or subcutaneously, howev may kill suddenly by forming gaseous emboli in the bl The same accident has also resulted from its introduction one of the large serous sacs. Owing to its oxidizing p also it is an active germicide and deodorizer. A 20 per solution of the official preparation quickly destroys pyog cocci and other non-spore-bearing bacteria. As an antis for general surgical purposes its drawbacks are its prone to deteriorate and the short duration of its action; its ad tages are its freedom from odor and from irritant and t properties. Its chief use is in the preliminary treatmen *septic wounds*, *abscess cavities*, and *fistulous tracts;* its effi in these cases being due in part to its antiseptic action an part to its mechanical action in expelling pus, blood-clots, detritus. It is generally applied diluted with from 1 to 3 p of water. It should not be injected into deep abscesses, un there is a free exit for the gas and pus, as otherwise ser harm may result from the increased tension within the cav neither should it be introduced, under any circumstances, in large serous sac, like the pleura or peritoneum.

A 25–50 per cent. solution of the official preparation makes an excellent wash or spray for the nose and throat in *diphtheria.* If an atomizer be used, the tube and nozzle should be of hard rubber or of glass, as contact with metal favors the decomposition of the dioxid. A solution of the same strength is also serviceable in *mercurial stomatitis*, in *noma*, and in *follicular tonsillitis.* Harris has found copious rectal injections of a dilute solution (1 : 4 or 8) of some benefit in *amebic dysentery.*

The bleaching properties of hydrogen dioxid render it useful, according to Bulkley, in *hiding superflous black hair* upon the face of women. Its physical action also makes it useful in removing the particles of carbon in gunpowder burns.

With the hope that it might impart some of its oxygen to the blood it has been recommended internally in a number of diseases, but in none has it gained any reputation.

## POTASSII PERMANGANAS, U. S. P.

(Potassium Permanganate; $KMnO_4$.)

Potassium permanganate occurs in the form of slender, dark-purple prisms, odorless, and of a sweetish, astringent taste. It is soluble in 15 parts of water, and is decomposed by alcohol. The dose is from 1–3 gr. (0.06–0.2 gm.) in pill form, after meals.

**Physiologic Action and Therapeutics.**—In concentrated solution potassium permanganate acts as an irritant or mild caustic. By the mouth, if the dose be sufficiently large, it produces the symptoms of a corrosive poison. In the presence of organic matter it quickly yields its oxygen; hence it is a prompt germicide and deodorant. Unfortunately, its usefulness is considerably restricted by the facility with which it is rendered inert by deoxidation. Solutions of potassium permanganate, however, make valuable deodorizing and detergent washes in many diseases attended with offensive discharges; thus, solutions of from 1–3 gr. (0.06–0.2 gm.) to the ounce (30.0 c.c.) may be used with advantage in *gangrenous stomatitis, cancer of the tongue, ozena, cancer of the uterus, foul ulcers*, and *bromidrosis.* A warm saturated solution makes a good *disinfectant for the hands*, provided it be followed by a saturated solution of oxalic acid to reinforce the permanganate and to remove the stain. A solution of from 1 : 6000 gradually increased to 1 : 1000, used by irrigation or by injection, is quite efficacious in *gonorrhea.*

Internally, potassium permanganate is used as an *emmenagogue* (see p. 248) and as an antidote to *morphin poisoning* (see p. 95).

**Incompatibles.**—Potassium permanganate has an ex
ingly wide range of incompatibilities. With oxidizable
stances, especially organic ones, like alcohol and glyceri
explosive.

## CALX, U. S. P.

(Lime; Quicklime; Burned Lime; CaO.)

Lime is obtained by burning the purest natural variet
calcium carbonate. It occurs in hard, white lumps, od
and of a sharp, caustic taste. It is soluble in 760 pa
water and is insoluble in alcohol. In the presence of
it evolves heat, and is gradually converted into calcium h
or slaked lime. Mixed with 3 or 4 parts of water, it f
magma which is known as milk of lime.

| PREPARATIONS. | DOSE. |
|---|---|
| Liquor Calcis, U. S. P. . . . . | ½–2 fl. oz. (15.0–60.0 c.c |
| Syrupus Calcis, U. S. P. (lime, 6.5 parts; sugar, 35; water, to make 100 parts) . . | ½–1 fl. dr. (2.0–4.0 c.c.) |
| Linimentum Calcis, U. S. P. (Carron oil: equal parts of lime water and linseed oil). | |
| Potassa cum Calce (Vienna paste; 50 per cent. of each). | |

**Physiologic Action and Therapeutics.**—Locall
is a quickly acting but superficial escharotic. It is nev
ployed by itself as a caustic, but in the form of potass
calce it is occasionally used to destroy *small epithel*
When thoroughly mixed with putrefying matter qu
favors disintegration, dispels offensive odors, and acts
to a limited extent as a disinfectant. Freshly prepared
lime is sometimes employed to disinfect fecal discharge
cium hydrate, in the form of lime-water (see p. 172) a
syrup of lime, is used as an antacid and a mild astringe

## SODII THIOSULPHAS, U. S. P.

(Sodium Thiosulphate; Sodium Hyposulphite; $Na_2S_2O_3.5H_2O$.

Sodium thiosulphate, or sodium hyposulphite, occurs i
transparent prisms, odorless, and of a cooling, somewha
taste. It is freely soluble in water. The dose is from 5
(0.3–1.3 gm.).

**Therapeutics.**—It is an excellent unirritating parasit
ringworm—*tinea circinata* and *tinea sycosis*—and in *tine*
*color*. It may be applied either as a lotion or as an oint
the strength of a dram (4.0 gm.) to the ounce (30.0 c.c.
It is also very effective in *ivy-poisoning*, in which it
prescribed as follows:

℞ Sodii thiosulphatis, ℥j (30.0 gm.);
Glycerini, f℥ss (15.0 c.c.);
Aquæ, q. s. ad f℥viij (240.0 c.c.). M.
Sig. Keep constantly applied.

A solution of 30 gr. (2.0 gm.) to the ounce (30.0 c.c.) makes a useful mouth-wash in *thrush*. Internally, it has been found of service as an antiseptic in *gastrectasis*, when sarcinæ and yeast are present in large quantities in the stomach-contents.

**Sodii Sulphis,** U. S. P. (Sodium Sulphite; $Na_2SO_3 . 7H_2O$) and **Sodii Bisulphis,** U. S. P. (Sodium Bisulphite; $NaHSO_3$). —These are salts sometimes employed as substitutes for sodium hyposulphite.

## ACIDUM BORICUM, U. S. P.

(Boric Acid; Boracic Acid; $H_3BO_3$.)

Boric acid occurs in colorless, transparent, pearly scales or crystals, odorless, and of a bitterish taste. It is soluble in 18 parts of water, 15.3 of alcohol, and 4.6 of glycerin. The dose is from 5–20 gr. (0.3–1.3 gm.).

PREPARATIONS.

Liquor Antisepticus, U. S. P. (contains 2 per cent. of boric acid, 0.1 per cent. of benzoic acid, 0.1 per cent. of thymol, 25 per cent. of alcohol, and minute quantities of eucalyptol, oil of peppermint, oil of gaultheria, and oil of thyme).

Glyceritum Boroglycerini, U. S. P. (contains 31 per cent. of boric acid in glycerin).

Unguentum Acidi Borici, U. S. P. (10 per cent.).

**Physiologic Action.**—In single moderate doses boric acid produces no appreciable symptoms. It is rapidly absorbed and rapidly eliminated, the bulk of it escaping in the urine within twenty-four hours after its administration. In very large doses it acts as an irritant poison. Its continued use in doses of a dram (4.0 gm.) a day not infrequently leads to a train of symptoms to which the term *borism* has been applied. The most important features of this condition are digestive disturbances, marked dryness of the skin and mucous membranes, a tendency to alopecia, erythematous or eczematous eruptions, areas of local edema, albuminuria, and cachexia. The same phenomena have also been observed after repeated external applications and rectal injections of boric acid. Although Annett found that kittens could not live longer than four weeks if fed upon milk containing small quantities of boric acid, it is the opinion of most experimenters (Rideal and Foulerton, Chitten-

den and Gies, Tunnicliffe and Rosenheim, Vaughan and
boer) that the drug when used as a food preservative doe
at least in adults, unfavorably affect nutrition.

According to Sternberg, boric acid has pronounced ant
properties, but is inefficient as a germicide.

**Therapeutics.**—As an unirritating, antiseptic wash, a
tion of boric acid (10 gr.: 1 fl. oz.—0.6 gm.: 30.0 c.c.)
wide range of usefulness in *inflammatory diseases of th
and throat.* A solution of from 5–15 gr. (0.3–1.0 gm.)
ounce (30.0 c.c.) may be employed with advantage as a
wash in *simple conjunctivitis* and during *operations on t*
Insufflations of boric acid are very valuable in *chronic oto*
in acute inflammation of the middle ear, however, espe
when the discharge is profuse and contains much mucu
drug may prove dangerous by clogging the outflow.
injections into the bladder of a warm solution (5 : 10 g
fl. oz.—0.3–0.6 gm. to 30.0 c.c.) are often useful in c
Lotions, ointments, and dusting-powders containing bori
are extensively used in many acute inflammatory skin dis
such as *erythema intertrigo, eczema, superficial burns,* an
*aria.* In *pruritus* a lotion of boric and carbolic acids freq
affords relief.

| ℞ | Phenolis, | ♏xx (1.2 c.c.); |
|---|---|---|
| | Acidi borici, | gr. xl (2.6 gm.); |
| | Glycerini, | f ʒiss (6.0 c.c.); |
| | Aquæ, | q. s. ad f ʒiv (120.0 c.c.). M |

Dusting-powders containing boric acid are sometim
service in *bromidrosis:*

| ℞ | Acidi borici, | ʒiss (6.0 gm.); |
|---|---|---|
| | Acidi salicylici, | gr. xx (1.3 gm.); |
| | Pulv. amyli, | ʒiv (16.0 gm.). M. |

Internally, boric acid is of some value in *cystitis with
line urine,* but, as a rule, it is less efficacious than urotro
benzoic acid.

**Incompatibles.**—Carbonates and bicarbonates.

**Sodii Boras, U. S. P.** (Sodium Borate; Borax; $Na_2$
$10H_2O$).—This salt occurs in colorless, transparent pris
as a white powder, inodorous, and of a sweetish, al
taste. It is soluble in 20.4 parts of water and in 1 part o
cerin, and is insoluble in alcohol. The dose is from 5–
(0.3–1.3 gm.). Its action is very similar to that of boric
for which it is often substituted. Internally, it has been
with some success in *epilepsy,* but it is much less useful

the bromids, and, moreover, in the large doses required it is often productive of grave constitutional symptoms. It is incompatible with acids, metallic salts, and alkaloids. Glycerin slowly converts it into boric acid.

## CARBO.

(Carbon.)

Carbon is official in the following forms:

*Animal charcoal* (*Carbo Animalis*, U. S. P.), *purified animal charcoal* (*Carbo Animalis Purificatus*, U. S. P.), and *charcoal* (*Carbo Ligni*, U. S. P.). Animal charcoal, or bone-black, is prepared by burning bones in closed iron cylinders. It is composed of carbon and calcium carbonate and phosphate. Purified animal charcoal is bone-black from which the earthy salts have been removed by hydrochloric acid. Wood charcoal is prepared from soft wood and is finely powdered. The dose is from ½–2 dr. (2.0–4.0 gm.).

Charcoal has the property of absorbing many times its own volume of gases or vapors. Owing to the oxygen condensed within its pores it has considerable oxidizing power, which may be utilized to destroy offensive gases, like hydrogen sulphid, and to hasten the decomposition of organic matter. Thorough wetting destroys its activity. As it is not absorbed when taken internally, it exerts no specific action on the body.

Charcoal is employed chiefly as an absorbent and a deodorant. In the form of a poultice it was at one time a favorite application for *foul ulcers*, but it has been largely displaced by more cleanly dressings. While it is a satisfactory agent for *deodorizing fecal discharges*, it has less disintegrating action than dry earth.

Internally, it is sometimes useful as an absorbent in *flatulent dyspepsia*. In may be given as a powder or in lozenges.

Animal charcoal is not used for medicinal purposes, but it is largely employed by chemists for removing coloring-matter from alkaloids. It was formerly regarded as an excellent filtering medium for drinking-water, but it has been shown to be unsafe for this purpose, since by adding phosphates and nitrates to the water it actually favors the development of bacteria.

## OTHER GERMICIDES, ANTISEPTICS, AND DEODORIZERS.

**Silver Compounds** (see pp. 369–374).—The salts of silver are powerful germicides. Many of the organic salts are not

so irritant as the nitrate, and, moreover, are not affect albuminous matters or chlorids. They are used especial mucous membranes.

**Bromin** (see p. 454).—This substance is an energeti infectant, but it is rarely used on account of its destructiv intensely irritant properties. A weak solution (1:400), ever, is occasionally employed as a deodorizer for cis trenches, slaughter-houses, etc.

**Ferrous Sulphate** (see p. 294).—This salt is a very disinfectant. It is sometimes used as a deodorizer for mi cesspools, etc.

**Volatile Oils.**—Many of the volatile oils, while th not actively germicidal, have considerable power as a tics. The oils of sandalwood, copaiba, and cubeb (s 230–232) are largely used as genito-urinary antiseptics.

**Methyl-blue** (**Pyoktanin**).—This substance, like m the anilin dyes, has some power as an antiseptic, but ver as a germicide. A solution of 1:1000 has been use some success in ophthalmic surgery.

**Methylene-blue** (see p. 420).—This compound, in of from 1–3 gr. (0.06–0.2 gm.), has been used as a urinar septic in gonorrhea. It is also of value as an antim though it is decidedly inferior to quinin.

**Acetanilid** (see p. 347).—This compound has been some extent as a substitute for iodoform in the treatm burns and ulcers.

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## ANTIMALARIALS.

Antimalarials are drugs that exert a curative influe malaria by acting destructively upon the specific parasite ent in the blood. The *alkaloids of cinchona*, especially are by far the most important members of this class. *Met blue* and *Warburg's tincture*, while they have some virt not approach quinin in efficacy. *Arsenic*, though us correcting the anemia caused by the parasites, does not to have any special action. Many other drugs have be ommended as antimalarials, but they have not been trustworthy.

## CINCHONA, U. S. P.

(Peruvian Bark.)

Cinchona is the bark of *Cinchona Calisaya* and other species of *cinchona*, tall evergreen trees indigenous in South America, and at present largely cultivated in India, Java, and Jamaica. Its activities depend upon a number of alkaloids, the most important of which are *quinin*, *quinidin*, *cinchonin*, and *cinchonidin*. To be up to the official standard the bark should contain at least 5 per cent. of total anhydrous cinchona alkaloids and not less than 4 per cent. of anhydrous ether—soluble alkaloids (quinin, quinidin, and cinchonidin).

In addition to its alkaloids, cinchona contains quinic acid, quinovic acid, and quinotannic acid.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Cinchonæ, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Tinctura Cinchonæ, U. S. P. | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Tinctura Cinchonæ Compositæ, U. S. P. (Huxham's Tincture: red cinchona, 10; bitter orange-peel, 8; serpentaria, 2; glycerin, 7.5; water, 7.5; alcohol, to make 100) | 1–4 fl. dr. (4.0–15.0 c.c.). |

The following alkaloids and their salts are also employed medicinally:

| | |
|---|---|
| Quininæ, U. S. P.<br>Quininæ Sulphas, U. S. P.<br>Quininæ Bisulphas, U. S. P.<br>Quininæ Hydrochloridum, U. S. P.<br>Quininæ Hydrobromidum, U. S. P. | 1–30 gr. (0.06–2.0 gm.). |
| Quininæ Salicylas, U. S. P.<br>Quininæ Tannas<br>Quininæ Valeras | 1–10 gr. (0.06–0.6 gm.). |
| Quininæ Dihydrochloridum | 1–30 gr. (0.06–2.0 gm.). |
| Quininæ Dihydrochloridum Carbamidata (quinin and urea hydrochlorid) | 1–20 gr. (0.06–2.0 gm.). |
| Oleatum Quininæ, U. S. P. (25 per cent.). | |
| Cinchoninæ Sulphas, U. S. P.<br>Cinchonidinæ Sulphas, U. S. P. | 1–30 gr. (0.06–2.0 gm.). |
| Cinchonidinæ Salicylas | 1–10 gr. (0.06–0.6 gm.). |
| Euquinin (an ethyl-carbonic ester of quinin) | 5–60 gr. (0.3–4.0 gm.). |

Quinin also enters into iron and quinin citrate, bitter wine of iron, syrup of the phosphates of iron, quinin, and strychnin, compound syrup of hypophosphites, glycerite of the phosphates of iron, quinin, and strychnin, elixir of iron, quinin and strychnin phosphates, and Warburg's tincture.

Quinin is the most important alkaloid of cinchona, and represents very largely its active properties.

## QUININA, U. S. P.

(Quinin.)

Quinin occurs in the form of a white, flaky, amorpho
crystalline powder, odorless, and of an intensely bitter
It is almost insoluble in water, but is readily soluble in a
lated water, alcohol, and ether.

**Physiologic Action.**—In large doses (20.0 gr.—1.3
quinin causes a feeling of fulness in the head, ringing i
ears, deafness, headache, and sometimes dimness of v
The term *cinchonism* is applied to this group of symp
Toxic doses may cause in addition circulatory weakness,
nea, delirium, stupor, convulsions, and coma.

Although alarming symptoms have been produced by
doses of quinin, it is very doubtful whether in a human
death has ever resulted directly from the use of the drug

**Circulatory System.**—Small doses do not materially
the circulation, but very large doses decrease the forc
frequency of the pulse by directly depressing the heart
contained ganglia.

**Nervous System.**—Toxic doses congest the brain, and
ably first stimulate and then depress the cerebral and
centers. The tinnitus aurium and deafness occurring i
chonism are doubtless the result of an intense congesti
the middle ear and labyrinth. In rare instances, appa
owing to chronic inflammation of the auditory passages
hemorrhage into the labyrinth, the deafness has been perm
Recent studies tend to show that quinin amblyopia resu
rectly from the toxic effects of the drug on the ganglion
of the retina, and not, as was formerly supposed, from
striction of the retinal arteries and secondary changes i
optic nerves. Permanent blindness from quinin is exceed
rare.

**Respiratory System.**—Respiration is not affected by c
except in poisoning, and then it may be slow and labored
depression of the center in the medulla.

**Alimentary Canal.**—In small doses it whets the ap
and stimulates gastric peristalsis. Large doses have an ir
effect and sometimes excite nausea and vomiting.

**Uterus.**—Quinin will sometimes intensify labor-pains
they are inefficient owing to weakness or fatigue. The
tractions induced by it are less prolonged than those follc
the use of ergot, and are probably caused by the direct a
of the drug on the uterine muscle. It does not seem ca
of originating labor-pains and acting as an abortifacient.

**Blood.**—As Binz originally noted, quinin, when added to freshly drawn blood, arrests the ameboid movement of the white cells. Moreover, when applied in very dilute solution to the exposed mesentery of a frog, it suspends, almost immediately, the migration of the leukocytes. These effects are ascribed to the toxic action that the drug exercises on all forms of undifferentiated protoplasm. Drawn blood, when mixed with quinin, loses in oxidizing power, as shown by its failure to strike a blue color with guaiac in the presence of turpentine and to decolorize indigo by transforming it into isatin.

**Metabolism.**—Under the influence of quinin there is a considerable falling off in the nitrogenous excretion, and as this continues for some time after the withdrawal of the drug, it would seem to be due to a retardative effect upon metabolism.

**Temperature.**—In health the bodily temperature is not appreciably influenced by quinin; in febrile states, however, large doses exert a pronounced antipyretic effect, which is thought to be due to an inhibition of metabolism, in consequence of which heat-production is diminished.

**Absorption and Elimination.**—Quinin is absorbed chiefly from the stomach, and is eliminated for the most part by the kidneys. Under favorable conditions it enters the blood very quickly, and traces of it may be found in the urine within twenty minutes after its ingestion. Its elimination, however, does not keep pace with its absorption, and after large doses, several days may elapse before all of it has left the body. It is excreted very largely unchanged, but a small part appears to be converted in the tissues into dihydroxyl-quinin.

**Action on Lower Organisms.**—Quinin is not an active germicide, although it is very destructive to certain protozoa, like the ameba and the hematozoon of malaria.

It is, however, an energetic antiseptic, and, in the proportion even of 1 : 800, it inhibits the growth of bacteria in fluids containing considerable organic matter.

**Untoward Effects.**—Idiosyncrasies to quinin are not infrequently encountered. In some individuals a dose of from 2–3 gr. (0.1–0.2 gm.) will cause intense cinchonism. Impairment of vision is fortunately rare, and has generally been produced by very large doses. Quinin rashes are not uncommon; of 60 cases analyzed by Morrow, 38 were erythematous, 12 urticarial, 5 purpuric, and 2 vesicular and bullous. Irritability of the bladder and urethra is occasionally noted.

**Therapeutics.**—Owing to its destructive action on the parasites of *malaria*, quinin is to be regarded as a specific in this

disease. The quartan and tertian hematozoa readily suc
to it, but the estivo-autumnal hematozoa are more resi
especially when in the crescentic or ovoid form. In ord
*intermittent fever* doses of from 15–30 gr. (1.0–2.0 gm.)
will generally arrest the paroxysms within three or four
The drug is most effective when its administration is so
that the maximum amount shall be in the blood durin
paroxysm—that is, while sporulation is in progress.
the daily dose may be divided into smaller doses of
(0.3 gm.) each, the first being given about eight hours a
last not less than three hours before the expected chill.
however, the patient is not seen until within a short time
expected paroxysm, a single large dose should be gi
once. The remedy should be continued in full doses un
paroxysms fail to appear, and then gradually withdrawn
period of several weeks. The administration of a la
dose of calomel as a preliminary measure increases the e
of the quinin, probably by facilitating its absorption. I
convalescence arsenic may be advantageously associate
the quinin.

In *estivo-autumnal fever* large doses—30–40 gr. (2.0–2.
a day—are usually required. In *pernicious malarial fe*
patient should be cinchonized as quickly as possible by
ing at once into the tissues of the thigh or buttock ab
gr. (2.0 gm.) of a soluble salt of quinin like the di
chlorid.

Whether the administration of quinin is at times resp
for the occurrence of hemoglobinuria in malarial subje
was first suggested by Verétas in 1858, is still a mooted
tion. Even if the affirmative be true, there does not
to be any good reason for withholding the drug in
of hemoglobinuria when malarial parasites can be dete
the blood. Bastianelli has summed up the matter in t
lowing rules: If hemoglobinuria occurs during th
oxysms and parasites are found, use quinin; if parasit
not found, do not use quinin; if quinin has been used
the hemoglobinuria begins and there are no parasites, c
tinue the quinin.

Quinin is not only a curative remedy in malaria, but
valuable prophylactic agent. Daily doses of from 4
(0.26–0.5 gm.) will generally prevent the incidence of t
ease in persons living in malarial regions. The drug do
afford immunity from the disease, but prevents the de
ment of the parasites.

Quinin, in doses of from 1–3 gr. (0.06–0.2 gm.), has long been used as a general tonic in *states of lowered vitality* following acute disease or brought on by overwork. In such cases it may be combined conveniently with iron and strychnin. Small doses are thought to be of some value also in *acute infections*, like septicemia, diphtheria, and influenza. It is possible that the drug owes its efficacy in these diseases, at least in part, to its retarding influence on the tissue changes. Warm rectal injections of the alkaloid (1 : 5000 to 1 : 2000) have been found of service in *amebic dysentery*. In *whooping-cough* moderately large doses are sometimes useful in lessening the severity and frequency of the paroxysms, but it is not known how the drug acts. Quinin has been recommended in *neuralgia* and in *headache*, when the attacks are more or less periodic, but unless these affections can be traced to a malarial origin, the drug is not likely to do good.

The use of quinin as an *antipyretic* (see p. 352) is almost obsolete. In doses of from 20–30 gr. (1.3–2.0 gm.) it undoubtedly has a pronounced effect upon high temperature, especially if it be given a few hours before a natural remission is expected to occur; but when drugs must be used at all as antipyretics, the preference should generally be given to the coal-tar derivatives, on account of the promptness and certainty of their action and their comparative freedom from disagreeable by-effects.

Quinin (10–15 gr.—0.6–1.0 gm.) is sometimes of value as an ecbolic (see p. 256) in the first stage of labor when the pains are infrequent and inefficient, owing to *simple uterine inertia*.

**Contraindications.**—The chief contraindications are meningitis and acute middle-ear disease. It should be administered cautiously when acute inflammation of the genito-urinary tract exists. There is some evidence to show that the drug sometimes acts unfavorably in epileptics in increasing the number of seizures. Of course, quinin should be withheld from patients in whom, owing to idiosyncrasy, it has previously caused grave symptoms.

**Administration.**—Under ordinary circumstances quinin should be given by the mouth. It may be prescribed in capsules, cachets, freshly made pills, or in solution. The last method of prescribing it, however, is objectionable on account of its intensely bitter taste. Old pills should be avoided, since they are liable to escape from the stomach before the alkaloid has been liberated and absorbed. The sulphate, though it is most commonly selected, is not so eligible as the more soluble

dihydrochlorid (4 parts of water), bisulphate (8.5 pa water), and hydrochlorid (18 parts of water). If the su be used, it should be rendered soluble by associating a few drops of one of the mineral acids.

To children the drug may be given suspended in sy yerba santa, syrup of chocolate, or elixir of licorice. Th nate, while it has less than half of the alkaloidal stren the sulphate, is only slightly bitter, and may, therefo given to children in the form of chocolates. Euquini tasteless and insoluble preparation, somewhat more activ the tannate.

Quinin is absorbed very imperfectly from the bowel, b young children it may be prescribed in the form of su tories, each containing 2 or 3 gr. (0.13–0.2 gm.) of a s salt like the dihydrochlorid.

For hypodermic use only the most soluble salts sho used, such as the dihydrochlorid, carbamidated dil chlorid, or bisulphate. If the bisulphate be chosen, the tion should be slightly acidulated with tartaric acid to p the precipitation of the salt by the alkaline juices of the t The injections should be intramuscular rather than subc ous, and should be given with the most thorough ant precautions.

Bacelli has reported excellent results in pernicious m fever from the employment of intravenous injections of He recommends the following solution:

℞ Quininæ hydrochloridi, gr. xv (1.0 gm.);
Sodii chloridi, gr. xij (0.8 gm.);
Aquæ destillatæ, f℥iiss (9.2 c.c.). M.
Sig. Boil and filter; inject while still warm.

Of the fluid preparations of cinchona, the compoun ture is the most effective. It is rarely used, however, as a restorative.

**Incompatibles.**—Alkalis, tannic acid, iodids, and sp nitrous ether.

**Cinchonin and Cinchonidin.**—The action of these loids is very similar to that of quinin, but it is much less po

## METHYLTHIONINÆ HYDROCHLORIDU U. S. P.

(Methylthionin Hydrochlorid; Tetramethylthionin Hydrochlorid; Me blue; $C_{16}H_{18}N_3SCl$.)

Methylene-blue is a complex anilin derivative, occur dark-blue crystals or as a bronze-like powder, slightly s

in water and in alcohol. The dose is from 1–4 gr. (0.065–0.26 gm.). Its action has not been carefully studied. When taken by the mouth or injected subcutaneously, it enters the blood and soon reappears in the secretions, especially in the urine, to which it imparts an intensely blue or greenish-blue color. Large doses irritate the stomach and also excite frequent and painful micturition. Achard and Castaigne, having found that in cases of renal disease the elimination of methylene-blue when injected intramuscularly is retarded as compared with the elimination in a normal subject, suggested that the degree of permeability of the kidneys might be determined by using as a criterion the time intervening between the injection of the drug and its reappearance in the urine. Subsequent studies, however, showed that this method, while of some value in determining the presence of interstitial nephritis, could not be depended upon in cases of parenchymatous nephritis.

The fact that methylene-blue is one of the best stains for the hematozoa of *malaria* suggested its use as a remedy in this disease. While it undoubtedly has some virtue, its efficacy is distinctly inferior to that of quinin. It may be used with advantage, however, when, owing to an idiosyncrasy, quinin cannot be taken. Berthier has found it useful in *dysentery;* he recommends warm injections containing from 1½–3 gr. (0.1–0.2 gm.) to a pint or quart (0.5–1.0 L.). Flint found it of service in cases of *filariasis*, but in a case studied by Henry it was without effect. The drug appears to be of some value as an antiseptic in inflammatory diseases of the genito-urinary tract, especially in *gonorrhea.*

The strong affinity shown by Ehrlich to exist between the axis-cylinders of nerves and methylene-blue prompted the use of the drug as an analgesic and a sedative. It has been employed as an analgesic by Lemoine, Klemperer, and others with asserted good results in *neuralgia*, *sciatica*, and *migraine*, and as a sedative by Bodoni and others in various forms of *insanity characterized by excitement.*

Methylene-blue may be administered by the mouth or subcutaneously. The former is the better method, as the injections are quite painful. It should be prescribed in pills or capsules, combined with half its weight of powdered nutmeg, the latter serving to prevent gastric disturbances and irritation of the bladder. If it be given hypodermically, the solution should first be sterilized by boiling, otherwise abscess is liable to occur. Patients should always be warned of the discoloration of the urine caused by the drug.

## WARBURG'S TINCTURE.

(Antiperiodic Tincture.)

Warburg's tincture was for a time a proprietary prepar but in 1875 the originator himself made known its com tion. As a number of the ingredients recommended by burg are no longer obtainable, the remedy is at the pr day prepared after a somewhat simpler formula than the nal one. Each fluidounce (30.0 c.c.) contains: Quini gr. (0.65 gm.); rhubarb and angelica seed, of each, 3½ g gm.); elecampane, saffron, fennel, and extract of aloes, of 1⅛ gr. (0.1 gm.); gentian, zedoary, cubeb, myrrh, white a and camphor, of each, ⅛ gr. (0.05 gm.). The value o tincture as an antimalarial, especially in the *severer for estivo-autumnal fever* which prevail in tropical countrie pears to be well established. To be effective it is nece that it should produce copious diaphoresis, and to this should be given in doses of half an ounce (15.0 c.c.), undi all drink being withheld from the patient. Playfair has it very efficacious as an antipyretic in protracted cas *puerperal sepsis.*

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# ANTHELMINTICS.

Anthelmintics or vermifuges are drugs which destroy pel intestinal worms. The principal members of this clas

**For tape-worms:**

Aspidium. Pumpkin-seed.
Pomegranate. Kamala.
Kousso. Oil of turpentin
Chloroform. Thymol.

**For round-worms:**

Santonin. Spigeli
Chenopodium.

**For seat-worms or pin-worms:**

Santonin or Spigelia by the mouth and one of the ing drugs by rectal injection:

Quassia. Vinegar.
Lime-water. Sodium chlori
Tannin.

**For ankylostomes or hook-worms:**

Thymol. Betanaphth

Anthelmintics are most effective when preceded and followed by purges. In the case of the tape-worm it is advisable that the patient should fast, or, at least, be restricted to very small quantities of liquid food for twenty-four hours before taking the anthelmintic.

## ASPIDIUM, U. S. P.

(Male Fern; Filix-mas.)

Aspidium is the rhizome of *Dryopteris Filix-mas* and of *Dryopteris marginalis*, ferns growing in North America, Europe, and Asia. It contains a fixed oil, a volatile oil, resin, *filicic acid*, and a number of neutral bodies, the chief of which is *aspidin*. Of these, filicic acid and aspidin are probably the most active constituents.

| PREPARATION. | DOSE. |
|---|---|
| Oleoresina Aspidii, U. S. P. . . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |

**Physiologic Action and Therapeutics.**—In overdoses aspidium is an energetic poison, producing abdominal pains, vomiting and purging, vertigo, headache, increased reflex activity, tonic spasms, collapse, and coma. Temporary or permanent blindness has also been present in many of the cases. Of 78 cases of poisoning by male-fern collected by Sidler-Huguenin, in 12 death occurred, and in 18 there was lasting impairment of sight in one or both eyes. According to Okamoto, microscopic examination of the eyes of poisoned dogs shows degenerative changes in the optic nerves.

Aspidium is perhaps the most generally useful remedy for *tape-worm*. A dram (4.0 c.c.) of the oleoresin may be given in emulsion or in capsules at bedtime, and followed in the morning by a saline purgative. Castor oil should not be used, as it is believed to increase the toxicity of aspidium by favoring the absorption of its active constituents.

## GRANATUM, U. S. P.

(Pomegranate.)

Pomegranate is the bark of the stem and root of *Punica Granatum*, a small tree indigenous in Southwestern Asia, and cultivated in most subtropical countries. It contains, in addition to a large quantity of tannin, a number of alkaloids, the chief of which is *punicin* or *pelletierin*. The latter represents very largely the anthelmintic properties of the bark, and occurs as a colorless oily liquid, capable of uniting with acids to form

crystalline salts. The official pelletierin tannate (*Pelleti Tannas*) is a mixture in varying proportions of the tannat several alkaloids contained in the bark. It may be giv doses of from 5–8 gr. (0.3–0.5 gm.).

| PREPARATION. | DOSE. |
|---|---|
| Fluidextracti Granati, U. S. P. . . . . | 1–2 fl. dr. (4.0–8.0 c.c |

**Physiologic Action and Therapeutics.**—Locally, egranate is astringent. Internally, large doses of the ba of the alkaloid may cause headache, vertigo, dimness of v nausea, vomiting, and extreme muscular weakness. Th symptom is said to result from paralysis of the peripheral of the motor nerves.

Pomegranate is a reliable remedy for *tape-worm*, ra next to aspidium in efficiency. The fluidextract or a dec (1 oz.–31.0 gm.) is sometimes used, but these preparatio very unpalatable and less certain in their action than the loid. Adjuvant treatment is necessary as in the case other teniacides.

## CUSSO, U. S. P.

(Kousso; Brayera.)

Cusso is the female inflorescence of *Hagenia abyssin* ornamental tree growing in the mountainous districts of sinia. A neutral body, *kosotoxin*, is probably the active ple. The dose of the powdered drug is from 6–8 dr. (24. gm.). *Koussein*, which is probably an impure preparat kosotoxin, may be given in doses of from 15–30 gr. (1 gm.). The crystalline body known as *kosin* is inactive.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Cusso . . . . . | 2–6 fl. dr. (8.0–22.0 c |

**Therapeutics.**—Cusso, provided it be fresh, is a po teniacide. The fluid extract is less efficacious than an in in which the powdered flowers have been allowed to re both preparations, however, are unpalatable and are excite nausea and vomiting. Koussein is an active pr tion, but costly. It is readily taken, especially if disper cachets. Cusso does not usually require the assistanc purgative, but one should be given if the bowels do not within six or eight hours.

## PEPO, U. S. P.

(Pumpkin-seed.)

Pepo is the seed of the common pumpkin, *Cucurbita Pepo.* It contains a fixed oil and a resin, the latter probably being the active principle. The dose is from 1–3 ounces (31.0 gm.–93.0 gm.).

Pumpkin-seed is a perfectly safe, but somewhat uncertain, remedy for *tape-worm.* It is usually prescribed in the form of an emulsion, made by beating the decorticated seeds into a paste, adding sugar, and diluting with water or milk. It should be taken in the morning on an empty stomach, and followed in two or three hours by castor oil.

## KAMALA.

(Rottlera.)

Kamala is a brownish-red, tasteless powder, consisting of the minute glands and hairs obtained from the surface of the capsules of *Mallotus philippinensis*, a small tree growing in western Asia and the neighboring islands. It contains several resinous principles, one of which occurs in yellow needles and is known as *rottlerin.* The dose of the powder is from 1–2 dr. (4.0–8.0 gm.).

**Therapeutics.**—Kamala has been highly spoken of as a teniacide by East Indian surgeons. It is rarely employed in this country. It is best given suspended in syrup or honey. A purgative is seldom required after it, as the drug itself causes considerable intestinal irritation and diarrhea.

## SANTONINUM, U. S. P.

(Santonin.)

Santonin is a neutral principle obtained from santonica, or Levant wormseed (*Artemisia pauciflora*), a perennial shrub growing in Turkestan. It occurs in white, shining prisms, odorless, and of a slightly bitter taste. It is nearly insoluble in water, but readily so in alkaline solutions. The dose for a child is $\frac{1}{4}$–1 gr. (0.016–0.065 gm.); for an adult, 1–5 gr. (0.065–0.3 gm.).

| Preparation. | Dose. |
|---|---|
| Trochisci Santonini, U. S. P. (each troche contains $\frac{1}{2}$ gr.—0.03 gm.). . . . . | 1–5 troches. |

**Physiologic Action and Therapeutics.**—In therapeutic doses santonin produces no special symptoms except an intensely yellow coloration of the urine and sometimes yellow vision, or xanthopsia. The last symptom is probably the

result of a specific action of the drug on the nerve-cente retina, although some investigators believe it to be due si to staining of the humors of the eye. The fate of santon the body is not definitely known. A part is undoubtedl sorbed, probably as a santoninate, is largely oxidized i tissues, and finally excreted in the form of oxysantonins.

Santonin poisoning is characterized by yellow vision, riasis, vertigo, tremors, unconsciousness, and violent co sions, first epileptiform and then tetanic. Nausea and vom have been observed in some instances. When death resu is usually through asphyxia. The convulsions are d stimulation of the motor centers—first the cerebral and the spinal.

Santonin is used almost exclusively as a remedy fo *round-worm*. It may be prescribed in lozenges or in pow mixed with a few grains of sugar. A good plan is to gi drug morning and evening and to follow it next day by a cathartic like castor oil or calomel. For a child unde years the dose should never be more than $\frac{1}{2}$ gr. (0.03 and for a child under five years, never more than 1 gr. gm.). Santonin has been recommended in certain other tions, notably in amaurosis, amenorrhea, incontinence of and epilepsy, but its claims to confidence are very doubt

## SPIGELIA, U. S. P.

(Pinkroot.)

Spigelia is the rhizome and roots of *Spigelia marilan* perennial herb growing in the Southern United States. tains a volatile oil, tannin, a bitter principle, and an a known as *spigelin*.

| PREPARATION. | DOSE. |
|---|---|
| Fluidextractum Spigeliæ, U. S. P. . . . . | ½–2 fl. dr. (2.0–8.0 c |

**Therapeutics.**—Spigelia is a very efficient, and, if able care be used in its administration, a perfectly safe for the *round-worm*. Toxic doses produce excitement, f of the face, swelling of the eyelids, dilatation of the dimness of vision, and, finally, stupor. It should alw administered in association with a purge.

## CHENOPODIUM.

(American Wormseed.)

Chenopodium is the fruit of *Chenopodium anthelmin* perennial herb indigenous in Central and South Amer naturalized in the United States. The active princi

volatile oil (*Oleum Chenopodii*, U. S. P.), the dose of which is from 3–10 min. (0.2–0.6 c.c.).

**Therapeutics.**—Chenopodium is a reliable vermicide for *round-worms*—less pleasant to take, however, than santonin or spigelia. The oil, which is almost exclusively used, should be given on sugar or in an emulsion three times a day, and followed by a brisk purgative every other day.

## OTHER ANTHELMINTICS.

**Oil of Turpentine** (see p. 236).—This drug was formerly much used as an anthelmintic for *tape-worm*, but it has been almost entirely supplanted by remedies that are more agreeable and quite as efficacious. If it be selected as a teniacide, it should be given in doses of half an ounce (15.0 c.c.) combined with an equal amount of castor oil.

**Chloroform** (see p. 123).—This drug, in doses of ½–1 fl. dr. (2.0–4.0 c.c.), has been used to a limited extent as a teniacide, but it is unreliable.

**Quassia** (see p. 175).—Rectal injections containing quassia are very efficacious in *oxyures*, or *pin-worms*. To secure the best results the lower bowel should first be thoroughly emptied by means of a soap-and-water enema, after which 2 ounces (60.0 c.c.) of a cold infusion of quassia (1 oz. to 1 pint —31.0 gm.–0.5 L.) should be slowly injected. As the parasites often occupy the cecum and small intestine as well as the rectum, it may be necessary, in some instances, in order to secure permanent relief, to give also by the mouth an anthelmintic (spigelia or santonin) with a cathartic.

**Lime-water, Vinegar, Sodium Chlorid, and Tannin.**—These drugs are sometimes used in the form of rectal injections to destroy *pin-worms*. None is quite so efficacious as quassia. They may be used in the following proportions: Lime-water, undiluted; vinegar, 1 to 3; sodium chlorid, 1 dr. (4.0 gm.) to a pint (0.5 L.); tannin, ½ dr. (2.0 gm.) to a pint (0.5 L.).

**Thymol** (see p. 392).—This drug, in doses of 30 gr. (2.0 gm.) for adults, or 8–15 grains (0.5–1.0 gm.) for children, repeated in two hours, one day a week, a saline purge being administered before and after the treatment, is a valuable remedy in *uncinariasis* or *hook-worm disease*. It has been used also with some success as an anthelmintic against the *tape-worm*, especially the *Dibothriocephalus latus* and the *common round worm*.

**Betanaphthol** (see p. 394).—This drug, used in the same way as thymol, but in doses half as large, has been found very effective in *uncinariasis* or *hook-worm disease*.

# ANTITOXINS AND VACCINES.

Our knowledge of the subject of serum-therapy is the growth of the studies upon immunity.

**Immunity.**—The inborn insusceptibility of an individu a disease to which others are commonly susceptible consti *natural immunity*. Immunity the result of changes v have taken place in the body during the life-time of th dividual is termed *acquired immunity*. The latter may b result of disease naturally contracted (*unintentional immu* or it may be the result of injections of specific micro-orga or their spores in an attenuated form, or of minute dos virulent, specific micro-organisms, or of the dead bacteria their contained toxins, or of the serum of an animal tha been previously protected from the disease by one of methods (*intentional* or *artificial immunity*).

As Ehrlich, Calmette, and others have shown, the pov confer immunity is not confined solely to bacterial toxin is shared also by other organic poisons, like ricin (from c oil beans), abrin (from jequirity seeds), and the venc poisonous serpents. The study of the mechanism c munity has scarcely reached beyond the hypothetical Pasteur reasoned that a second infection was impossi many diseases, because in the first infection the bacteri used up substances that were necessary to their growth. theory at once became untenable when it was shown th metabolic products of bacteria were as powerful in con immunity as the bacteria themselves. Chauveau con the idea that the bacteria left material in the body whic dered the tissues unsuitable for subsequent infection. ous objection, however, to this theory is the fact th blood-serum of the animal artificially protected is in cases a good culture-medium for the special bacteri cerned. Metschnikoff believes that immunity depends e upon cellular activity (phagocytosis). He originally that the main factor in the process was the capacity leukocytes and of certain other cells to ingest and dest bacteria. The discovery of the immunizing power of sera necessitated a modification of this view, and this guished observer now teaches that the injection of protective substances exerts an "educational" or stim effect upon the phagocytes, in consequence of whic activity is so intensified that they ultimately become inv He further asserts that any bactericidal power that the fluids may possess is to be attributed to substances

from the stimulated leukocytes. That phagocytosis is an extremely important factor in the establishment of immunity is generally admitted; that it is the sole factor, however, is highly improbable. Pfeiffer demonstrated that cholera vibrios injected into the peritoneal cavity of the artificially immunized guinea-pig were destroyed without the aid of the phagocytes. The humoral theory evolved from the studies of Nuttal, Flügge, Behring, and others is well grounded on experimental data. This theory attributes immunity to the power of the extracellular fluids, especially of the blood-serum, to neutralize the poisons made by bacteria or to destroy the bacteria themselves. These antitoxic or bactericidal powers are believed to be due, however, to substances derived from the cells. Those substances which neutralize toxins are known as *antitoxins*, and those which disintegrate and dissolve the bacteria are known as *bacteriolysins*. In certain infections, like diphtheria and tetanus, immunity is chiefly antitoxic, while in others, like cholera and typhoid fever, it is mainly antibacterial.

The manner in which these protective bodies act has not yet been clearly explained, but the "lateral-chain" theory of Ehrlich is highly suggestive. This theory presupposes that the protoplasm of the cells contains complex molecules having a comparatively stable central group of atoms, to which are attached much less stable lateral chains of atoms.

These lateral chains have the power of fixing or "anchoring" such toxins for which they have an affinity, a group of atoms of the cell entering into combination with a group of the toxin. These are designated *haptophore* groups. In addition to its haptophore group the toxin contains a *toxaphore* group, which carries its toxic properties, but this toxaphore group cannot act upon the cell until the toxin has been anchored to the cell by a union of the haptophore groups. The haptophore groups of the cells, which are also known as *receptors*, can unite only with the haptophore groups of toxins for which they have a special affinity; hence a toxin may prove harmless for the want of a receptor having an affinity for it (natural immunity). In anchoring the haptophores of the toxin by means of its receptors the cell suffers a defect, which, according to definite natural laws, is repaired by a new formation of receptors of the same functional quality. Further fixation ultimately leads to the formation of receptors in excess of those previously existing. These extra receptors, separated from the cells and free in the blood-plasma, are the *antitoxins* which unite with the toxins and neutralize them by preventing their union with receptors still attached to the cells.

In the case of antibacterial immunity, Ehrlich holds tha extra receptors serve as an *immune body*, without which an body, normally present in the blood and probably derived the leukocytes, termed the *complement* (alexin of Buch cannot exert any bactericidal influence. The immune b which is also known as the *amboceptor*, has two haptop groups, one having an affinity for the complement (*co mentophilic*), the other having an affinity for the bacte (*cytophilic*). After the complement has become anchor the complementophilic group of the amboceptor it is ab bring about the solution of the bacterium (bacteriolysis).

The subject of artificial immunity is closely related to of serum-therapy, inasmuch as it has been well estabi that a susceptible animal which has been rendered artifi immune against a certain infection is capable of furnish serum which, injected into other susceptible animals, wil tect them from a like infection, and even arrest such fection if it is just beginning. Many pathogenic ba furnish both an antitoxin and a bacteriolysin, but usuall in greater proportion than the other. Thus far, decided peutic results have been obtained only in those infe the bacteria of which furnish serum especially rich in ant bodies. As antitoxins only neutralize toxins and have no to undo the damage that the latter have already wrough evident that the earlier they are administered in any inf the more effective they will be.

Another class of substances in the blood-serum appa plays an important part in bacteriolysis. It has been by Wright that the leukocytes do not readily take u digest bacteria unless they are aided by certain bodies plasma, which he has termed *opsonins*.[1] These opsoni upon the bacteria in such a way as to make them an eas to the leukocytes. The ratio between the average num bacteria taken up by healthy leukocytes in a mixture of terial suspension with a patient's blood-serum and the a number taken in a mixture of the same bacteria with serum is known as the *opsonic index*. The latter, nc taken as 1.0, is low in most infections. By the injecti cutaneously of measured small quantities of dead b (vaccines or bacterins) it is possible to raise considera opsonic power of the blood-serum and so favor phago Good results have been obtained from successive vacci with specific bacteria, after the method of Wright, in

[1] From the Greek word "opsono," I cater for.

cases of tuberculosis, gonorrhea, staphylococcus infections (furunculosis, acne), and Bacillus coli infections.

## SERUM ANTIDIPHTHERICUM, U. S. P.

(Diphtheria Antitoxin.)

Diphtheria antitoxin is obtained from the horse, the animal having been rendered artificially immune by repeated injections extending over a period of several months, of gradually increasing quantities of the strongest diphtheria toxin. As the bacilli themselves are not injected, the horse does not become infected with diphtheria, but he gradually acquires a tolerance for the toxins of the disease and develops in his blood a substance (antitoxin) which has the power to neutralize those toxins. At the proper time, when it is thought that his blood has acquired the requisite degree of potency, the animal is bled, and the serum—the part of the blood containing the antitoxin—is carefully separated from the clot, filtered, and standardized. The last procedure is accomplished by determining the quantity of antitoxin serum required to offset the effects of the minimum quantity of toxin necessary to kill a guinea-pig in a definite time. The strength of the antitoxin is measured in units, a unit containing the amount of antitoxin required to save the life of a guinea-pig which has been injected with 100 fatal doses of toxin. Irrespective of the toxin injected and of the duration of the immunizing treatment, the serum yielded by different horses varies considerably in antitoxin strength. Only a very small percentage of horses give more than 1000 units in a cubic centimeter.

**Therapeutics.**—Diphtheria antitoxin has both preventive and curative power. The immunity afforded by it is but temporary, rarely lasting more than two or three weeks. The prophylactic dose is from 500 to 1000 units. That it is a powerful curative agent is evident from the fact that the mortality of diphtheria has been reduced at least 50 per cent. since the introduction of serum treatment. Baginsky claims that the mortality has fallen from 41 to 8 or 9 per cent. In 5576 cases (moribund cases excluded) collected by the American Pediatric Society, mostly from the private practice of American physicians, the death-rate was 8.8 per cent.

In the laryngeal cases the figures have been reversed; instead of a mortality of 70 per cent. or more, the recoveries now number 70 per cent. or more. The chances of recovery in all cases vary directly with the time of administration. The statistics of the American Pediatric Society show that if

antitoxin is injected upon the first day the death-rate is 4.9 per cent.; if upon the second day, 8.6 per cent.; if upon the third day, 12.7 per cent.; if upon the fourth day, 22.9 per cent.; and if after the fourth day, 38 per cent. In pharyngeal cases, if the patient is seen early, the dose should be 3000 units; when treatment is inaugurated rather late and the case is severe, the dose should not be less than 4000 units. Laryngeal cases require 4000 to 8000 units. Unless decided improvement follows the initial dose within from four to six hours, a second and much larger dose should be given. As antitoxin is practically harmless, the danger lies not in using too much, but in using too little. No allowance should be made for age, as children are more susceptible to the disease than adults. Antitoxin deteriorates with age, and therefore only fresh preparations should be used. Whether the serum acts indirectly through the cells (vital reaction) or directly by combining with the toxin (chemical reaction) is not known, though the weight of evidence is in favor of the latter view. Antitoxin is probably eliminated through all the emunctories. It has been found in the urine and milk.

**Administration.**—As antitoxin is absorbed very slowly and imperfectly from the stomach, it should always be given subcutaneously. The needle may be inserted into the loose subcutaneous tissue of the pectoral region, side of the abdomen, or interscapular space. Strict antiseptic precautions should be taken in the operation. Manipulation of the swelling to hasten the absorption of the serum is undesirable.

**Untoward Effects.**—The most common of these is an urticarial or erythematous rash. A rise of temperature of short duration occurs in about 20 per cent. of the cases. Joint pains, and even slight effusion into the joints, occur in about 6 per cent. of the cases. These effects are probably not produced by the antitoxin itself, but by other substances in the serum, since they may occur on injecting normal horse's serum. The increased frequency of complications like paralysis and albuminuria since antitoxin has been used is to be attributed to the fact that there are more recoveries than formerly.

## OTHER ANTITOXINS AND VACCINES.

**Tetanus Antitoxin.**—Tetanus antitoxin is obtained in the same manner as diphtheria antitoxin—that is, by inoculating the horse with increasing doses of tetanus toxin. The unit is ten times the least quantity of antitetanic serum necessary to save the life of a 350-gram guinea-pig for ninety-six hours

against the official test dose of a standard test toxin furnished by the Hygienic Laboratory of the Public Health and Marine Hospital Service. The dose of the serum as a prophylactic is 1500 units; as an antidote, from 3000 to 6000 units.

Unfortunately, the curative effects of tetanus antitoxin are not comparable to those of diphtheria antitoxin. The chief reasons for this are, first, the great virulence of the toxin produced in many of the cases of tetanus, and, secondly, the advanced stage that the disease must reach before it is recognizable. In the case of diphtheria the diagnosis is usually made before much toxin has been absorbed into the system; in the case of tetanus, however, diagnosis is impossible before the nerve-centers are fully under the influence of the toxin. Serum-therapy does not appear to have materially lowered the mortality in grave cases of tetanus—that is, in cases in which the period of incubation was less than seven or eight days; on the other hand, it seems to have been of some service in the more chronic cases of the disease, cases in which the period of incubation ranged between eight and twenty-four days.

In order that the antitoxin might be brought in direct contact with cells of the central nervous system, for which the toxin of tetanus has a great affinity, Roux and Borrell recommended the intracerebral injection of the serum, but the results from this method of administration have not been very encouraging. Recently Jacob and others have obtained promising results from subarachnoidal injections through a lumbar puncture. Despite the poor showing of the antitoxin treatment, we are of the opinion that it should be used early and energetically in every case of tetanus, but not to the exclusion of other measures known to be of benefit. As the serum, even in small doses, has considerable immunizing power, it should be given promptly as a prophylactic remedy in all suspicious wounds, especially in those which have become contaminated with garden earth, street dirt, or stable refuse.

In the last two years the tetanus mortality incident to blank cartridge and cannon-cracker wounds received in Fourth of July celebrations has been remarkably reduced by antitoxin prophylaxis.

**Antistreptococcus Serum.**—A serum obtained from horses after they have received repeated injections of streptococcus cultures has been offered as a remedy in various diseases due to streptococcus infection. These diseases include erysipelas, puerperal fever, septicemia, ulcerative endocarditis, and infective lymphangitis. Numerous cases are on record in which good results are attributed to the serum, but the statistics collectively do not indicate that it has had a very decided

influence in lowering the mortality of septic diseases. ever, as the serum when sterile and pure is practically less, there seems to be no good reason for not givin thorough trial in cases of infection demonstrated by ba logic examination to be due to the streptococcus. A there are no accurate data upon which the dosage m computed, but from 20 to 30 c.c. of a reliable serum n given two or three times a day so long as the fever r high. As the potency of the serum is notably impai keeping, preparations more than two or three weeks old not be used.

Injections of the *toxins* produced by streptococci hav advocated in *inoperable malignant tumors*, but the treatr not without danger and has failed to secure the indor of most surgeons. It must be admitted, however, that been apparently successful in a few instances in arresti growth of sarcomatous tumors and even in effecting a

**Antipneumococcic Serum.**—It has been clearly strated that the blood-serum of animals artificially imm against pneumococcic infection possesses definite antitoxi erties. A serum obtained from horses which hav repeatedly inoculated with cultures of pneumococci o virulence has been applied to the treatment of pneum human beings, but the reports thus far presented are to partial observer certainly not very encouraging. Acc to a summary published by Anders, the mortality in 53 of pneumonia in which antipneumococcic serum was em was 18.3 per cent.

**Antimeningococcic Serum.**—In the last few ye forts have been made by a number of experimenters, r by Wassermann, Jochmann, and Flexner and Jobling, t duce a serum capable of influencing the course of c spinal fever. The serum of Flexner and Jobling is pr by inoculating horses first with cultures of different str meningococcus heated to 60° C. for thirty minutes an with living organisms and autolysates. While the hand are too few to justify a positive opinion as to the of the serum, the results thus far achieved have been so aging as to warrant a thorough trial of the remedy in a able cases. In a series of 400 cases treated with the the mortality, excluding the cases in which death oc within twenty-four hours, was 25 per cent., which, of co very much less than the average mortality under sympt treatment. The intradural method of administration ferred because it brings the serum at once into direct

with the active focus of infection. Introduced in this way the serum seems not only to cause disintegration of the meningococci and to increase phagocytosis but also to exercise some antitoxic influence. From 30 to 40 c.c. of the serum are injected into the spinal canal after about an equal amount of cerebrospinal fluid has been withdrawn, and it is advised that the treatment be repeated every twenty-four hours for three or four days. The earlier in the attack the serum is given the better, of course, the outlook.

**Tuberculin and Antituberculous Serum.**—In 1890 Koch introduced as a specific remedy for tuberculosis a preparation to which the name *tuberculin* was applied. This was subsequently shown to be an extract of the metabolic products of tubercle bacilli preserved in glycerin.

Koch did not consider this original tuberculin as an immunizing agent, but believed that by reinforcing the toxin already in the body it would increase the irritation at the seat of infection, attract leukocytes, and, ultimately, lead to the complete encapsulation of the bacilli. It is now known, however, that Koch's tuberculin and all similar preparations act by stimulating the defensive resources of the organism and producing probably both antitoxic and antibacterial immunity.

Unfortunately, tuberculin at first was applied without skill and often in unsuitable cases, and, consequently, it soon fell into discredit. During the last five or six years it has again been employed, especially in the sanitoriums, and has gained the reputation of being a valuable addition to our therapeutic agents when used in appropriate doses and in certain forms of the disease. Originally it was supposed that definite reactions on the part of the patient were a necessary consequence of the treatment, but at present it is believed that such reactions are absolutely harmful. The cases best adapted to tuberculin treatment are the chronic ones, with little or no fever.

Of the various tuberculins introduced during the past fifteen years, Koch's emulsion of crushed virulent bacilli (tuberculin B. E.) and filtrates of human cultures, such as Deny's tuberculin B. F., are now, perhaps, used most extensively. No matter which tuberculin is selected, the initial dose should be very small—$\frac{1}{1000}$ milligram of old tuberculin or $\frac{1}{10000}$ milligram of filtrate B. F. or Koch's B. E. (liquid measure, not solid substance). The injections should be given every four or five days, the dose being gradually increased, but never large enough to cause a definite immediate reaction. If evidences of increasing sensitiveness appear, the injections should be stopped for a time and then commenced with smaller doses.

In this way a high degree of tuberculin immunity is reached in from six months to a year, a dose of 1 c.c. tolerated with advantage.

*Antituberculous Serum.*—Maragliano has produced a which he claims as both antitoxic and bactericidal. It pared by injecting into an animal the filtrate of young c of tubercle bacilli and aqueous extracts of killed virule tures. Some very favorable reports from the use of this have appeared, but it is too soon to form any definite c as to its efficacy.

**Antianthrax Serum.**—Sclavo has prepared an antia serum which is apparently effective, both as prophylact as a therapeutic agent, in cattle as well as in man. produced by the treatment of sheep and asses with a bacilli subcutaneously, while at the same time or pre anthrax immune serum is given intravenously. Accor Legge, the mortality in 164 cases of external anthrax i treated with this serum was about 6 per cent., as co with 24 per cent. in all other cases occurring in Italy serum seems to be harmless, even when used in doses to 40 c.c., or more, intravenously.

**Bubonic Plague Antitoxins and Vaccines.**—I Yersin demonstrated that animals could be successfu munized against bubonic plague by subcutaneous inj of sterile cultures of plague bacilli, and, further, that the serum of animals thus artificially immuninized possessed tive and curative properties. Serum obtained after the of Yersin has been used with asserted good results in Amoy, Annam, Oporto, and elsewhere. Immunity co by this serum is said to last about a fortnight. Haffk prepared a prophylactic fluid which appears to be more than Yersin's serum. It is a fluid culture of pest bacill ized by heating to 70° C. for one hour. Haffkine that among 639,630 uninoculated persons there occur 433 cases of plague (7.7 per cent.), with 29,733 deaths cent.). Of 186,797 who had been inoculated with vaccine, 3399 (1.8 per cent.) took the disease and per cent.) died. The immunity afforded by this vaccin to last from four to six months.

Lustig recommends as a prophylactic a nucleopro tained from dead plague bacilli, and as a remedy a obtained by treating horses with this nucleoproteic stated that the rate of recovery under this serum in 4 was 39.36 per cent., against 20.6 per cent. of recoveries cases treated during the same time without serum.

**Cholera Vaccine.**—It has been shown by Pfei

others that the blood-serum of human beings who have recently recovered from attacks of cholera and of animals which have been artificially immunized has the property of disintegrating and dissolving cholera vibrios. Unfortunately, this bacteriolytic serum has thus far proved unavailing when applied to the treatment of cholera in human beings. Haffkine, however, appears to have been measurably successful in producing artificial immunity in human beings by means of subcutaneous injections of attenuated cholera cultures.

**Antityphoid Serum and Typhoid Vaccine.**—It has been shown that the blood-serum of animals artificially immunized by gradually increasing doses of living or dead typhoid bacilli acquires specifie bacteriolytic and antitoxic properties. Applied to the treatment of typhoid fever, antityphoid serum has generally yielded negative results, although Chantemesse, of Paris, seems to have employed it with considerable success. Protective vaccination, however, by means of sterile cultures of the typhoid bacillus, as practised by the British military surgeons in South Africa and India, appears to have been very efficient. Leishman states that of 5473 soldiers inoculated, only 21 were subsequently infected, with two deaths, while of the 6610 non-inoculated in the same regiment, 187 had typhoid and 26 died.

**Antivenene.**—The studies of Sewall, Phisalix and Bertrand, Calmette, Frazer, and others have established the fact that animals can be successfully immunized against the venom of poisonous snakes by being inoculated with increasing doses of venom, and, further, that the blood-serum of animals thus treated possesses both protective and antidotal properties. The more recent work, however, of Flexner and Noguchi and others has shown that antivenoms are highly if not absolutely specific, and to be of any practical value, therefore, a protective serum will have to be polyvalent.

**Antidysenteric Serum.**—A serum has been prepared by immunizing the horse against the dysentary bacillus (Shiga-Kruse type), and the toxins elaborated by the bacillus, which is claimed to be both bactericidal and antitoxic. According to Shiga, the mortality in 298 cases of bacillary dysentery treated with this serum was 9 to 12 per cent., while it was 22 to 26 per cent. in 212 cases treated with drugs.

**Pollantin.**—Dunbar has prepared an antiserum by treating the horse with irritant toxins obtained from the pollen of grasses. This serum is supplied in liquid and powder forms, the former being used mainly on the eye and the latter in the nose. There is no unanimity among specialists as to the therapeutic value of the substance in hay-fever.

# IRRITANTS AND COUNTERIRRITANT

**Irritants** are substances which, when applied to the s of the body, cause active hyperemia or inflammation. they are applied not simply for their local action, but fluence for the better neighboring or remote morbid proc they are termed *counterirritants*. We have yet no clear u standing of the manner in which counterirritants do goo most plausible theory, however, is that they call forth re from the central nervous system centrifugal influences, motor or trophic or both, which act favorably upon perturbations.

Counterirritants which produce merely an acute hyp of the skin are known as *rubefacients;* those which act severely and lead to the formation of blisters are terme *cants* or *epispastics*; and those which act especially ducts of the sudoriferous glands, producing a crop of pu are called *pustulants.*

Counterirritation may be carried to a still greater deg intensity by producing ulceration, and for this purpos now customary to use the *actual cautery*. This may be a by means of irons of various shapes, heated to redne better still, by means of the Paquelin cautery, in which platinum-sponge is brought to incandescence by conta the vapor of naphtha or rhigolene.

Light applications of the thermocautery are ofter efficacious in certain deep-seated affections attende severe pain, such as sciatica, chronic meningitis, arthrit locomotor ataxia.

Still another method of producing a counterirritant applicable to certain painful affections, is *acupuncture*, consists in thrusting fine needles deeply into the tissue sciatica and lumbago this treatment sometimes gives b results. The needles should be four or five inches lo about the thickness of a bonnet-pin. Having been ste they should be inserted into the most painful spots to a of two or three inches, and allowed to remain for from fifteen minutes.

The most important rubefacients are:

| | |
|---|---|
| Mustard. | Capsicum. |
| Iodin. | Chloroform. |
| Oil of turpentine. | Ammonia. |
| Arnica. | Camphor. |
| Pitch. | Aconite. |
| | Volatile oils. |

Rubefacients may be applied with advantage in acute congestion of the internal organs, in inflammatory affections of a mild type, and in functional pains. Thus they are useful in acute congestion of the lung, acute bronchitis, acute catarrhal enteritis, gastralgia, intestinal colic, muscular rheumatism, and neuralgia of the superficial nerves. When applied over large surfaces they serve also as general stimulants, and as such may be employed to arouse the system in collapse, shock, and narcotic poisoning. They may be applied in the form of plasters (mustard), stupes (oil of turpentine), liniments (chloroform, arnica), or pigments (iodin).

The chief vesicant is cantharides.

A number of the drugs classed as rubefacients (ammonia, mustard, chloroform, iodin), if applied in concentrated form, will also produce vesication, but they are never employed for that purpose.

Vesicants exert a more profound and a more lasting effect than rubefacients. They are often of service in inflammatory diseases of a severe type, such as pleurisy, pericarditis, gastritis, iritis, arthritis, neuritis, etc., and in obstinate forms of neuralgia.

Vesicants are usually applied directly over the affected part, though some authorities hold that they should be placed some little distance from it. In neuralgia they are often most beneficial, as Anstie pointed out, when applied to a posterior branch of the spinal nerve-trunk from which the painful nerve issues. In trifacial neuralgia it is customary to apply the blister behind the ear.

The only pustulant in ordinary use is croton oil.

A mixture of croton oil (see p. 211) and olive oil (1 to 3), or the liniment of croton oil of the British Pharmacopœia (croton oil, 1 part; cajuput oil and rectified spirit, of each, 3½ parts), is sometimes of benefit as a counterirritant in bronchitis, pleurodynia, and dry pleurisy.

A large number of drugs which produce irritation when applied locally are used for their stimulant effects upon the superficial tissues themselves in various forms of chronic inflammation, such as subcutaneous indurations, indolent ulcers, and certain chronic skin diseases. Only those, however, which are used almost exclusively for this purpose will be considered here:

Chrysarobin.
Oil of cade.
Chaulmoogra oil.
Gurjun balsam.
Jequirity.

## CANTHARIS, U. S. P.

(Cantharides; Spanish Flies.)

Spanish fly is the dried beetle, *Cantharis vesicatoria*, secured chiefly in southern Europe. The active principle is *cantharidin*, the anhydrid of cantharidic acid. The latter does not exist uncombined, but its salts are obtained by acting on cantharidin with alkalis. Cantharidin occurs in colorless prisms, readily soluble in alcohol, ether, chloroform, or oils, but only sparingly soluble in water.

| PREPARATIONS. | DOSE. |
|---|---|
| Tinctura Cantharidis, U. S. P. . . . . | 1–5 min. (0.06–0.3 c.c.). |
| Ceratum Cantharidis, U. S. P. (cantharides, 32; liquid petrolatum, 15; yellow wax, 18; rosin, 18, and lard, 17). | |
| Collodium Cantharidatum, U. S. P. (cantharidal collodion contains 60 per cent. of cantharides). | |

**Physiologic Action.**—When applied to the skin, preparations of cantharides produce redness and burning, and, later, vesication. If the action of the drug be allowed to continue, it may ultimately lead to pustulation, ulceration, and sloughing. A cerate of good quality requires from six to ten hours to produce a blister, the time varying with the part to which it is applied and the condition of the skin. To mucous membranes cantharides is also highly irritating, that of the genito-urinary tract being especially susceptible to its influence.

Internally doses of from 5–10 min. (0.3–0.6 c.c.) increase to some extent the excretion of urine, and often cause frequent desire to micturate, with some dysuria. The active principle of the drug is rapidly eliminated by the kidneys. Toxic doses are followed by intense irritation of the alimentary canal and of the genito-urinary tract. The symptoms of poisoning are burning pain in the mouth, throat, and stomach, dysphagia, great thirst, ptyalism, vomiting and purging of mucous and bloody material, and extreme prostration. Later, when a sufficient quantity of the poison has been absorbed, symptoms referable to the genito-urinary tract appear, such as aching pains in the loins, a constant desire to urinate, severe vesical tenesmus, with the passage of merely a few drops of bloody, albuminous urine, and, in males, priapism. Erotic excitement sometimes occurs, and in women abortion may follow the powerful irritant effects of the drug upon the pelvic viscera. In fatal cases death may be preceded by coma and convulsions. If the cantharides has been taken in the form of powder, the

characteristic shining green parts of the insect may be recognized in the vomitus. Section after death shows gastro-enteritis and glomerulonephritis.

Cantharides is absorbed readily from the skin, and a number of cases are on record in which severe and even fatal nephritis has resulted from too free vesication. Owing to unusual susceptibility, the use even of very small blisters in some persons is followed by strangury.

**Treatment of Poisoning.**—This consists in evacuating the stomach, and in relieving the local irritation by the free administration of demulcents. Opium may be required for the pain. Fatty substances should be withheld, as they dissolve cantharidin and so favor its absorption. The treatment of cantharidal nephritis does not differ from that usually adopted in other forms of the disease. The treatment of strangury consists in applying hot fomentations to the lower part of the abdomen, in giving freely diluent drinks, and in administering rectal injections of laudanum.

**Therapeutics.**—The most important use of cantharides is as a counterirritant. As a vesicant it is often of decided value in acute inflammation of serous membranes—*pleurisy*, *pericarditis*, *synovitis*, etc. In the early stage of these diseases it tends to relieve the pain, and, later, it aids in the absorption of the effusion. In severe forms of *neuritis* small blisters may be applied with advantage over the course of the affected nerve. In *facial neuralgia* blistering behind the ear may afford speedy relief. In *acute rheumatism* the application of blisters around the inflamed joint will often be found to relieve the pain and to reduce the swelling. In *pneumonia* of the usual type blisters are of doubtful value, but they are sometimes efficacious when used repeatedly in cases of *delayed resolution*. In the early stage of *phthisis*, when the cough is troublesome, counterirritation with cantharides often proves very beneficial. In *oöphoritis* the application of a blister over the affected gland is very advantageous. *Obstinate vomiting* due to acute irritation of the stomach sometimes yields promptly to a vesicant applied to the epigastrium.

The tincture of cantharides, well diluted, has an established reputation as a stimulant lotion in the treatment of *premature alopecia* and *alopecia areata*.

℞ Tincturæ cantharidis, ℥ss (15.0 c.c.);
Tincturæ capsici, ℥j (30.0 c.c.);
Olei ricini, ℥ss (2.0 c.c.);
Alcoholis, q. s. ad ℥iv (120.0 c.c.). M.
Sig. Rub into the scalp each night.

Internally cantharides has been used to some extent as a stimulant to the genito-urinary tract, in *incontinence of urine from atony of the bladder*, and in *chronic pyelitis*, *cystitis*, and *urethritis*, but it is neither so safe nor so efficacious as many other remedies in common use. Ringer and others have recommended small doses of the tincture in the treatment of *acute nephritis* when all symptoms of active inflammation have subsided and there is a tendency for the disease to assume a chronic type, but we would urge the utmost caution in using the drug in such cases. In very large doses, probably by irritating the bladder and urethra, cantharides sometimes excites the sexual appetite, hence it has been employed as an aphrodisiac; for this purpose, however, it is without merit.

**Administration.**—The tincture is the only form in which the drug is used internally. It should be taken after meals, well diluted. For blistering it is customary to use a plaster made of the cerate. The market is well supplied with good ready-made plasters which may be cut the desired size and shape. To obtain the best results the skin should be washed, and shaved if necessary, and then thoroughly dried; before the plaster is applied it should be moistened with vinegar or a few drops of oil. Vesication is generally induced in from six to ten hours; even if it is not, it is advisable to remove the plaster at the end of that time and to complete the operation by applying a poultice. In delicate subjects the poultice should be used at the end of three or four hours. When the bleb has fully developed, it should be opened with a large needle, and then dressed with a pledget of dry cotton. In many cases excellent results are obtained from a succession of blisters applied to different parts of the affected region and allowed to remain only long enough to produce a rubefacient effect (*flying blisters*). Cantharidal collodion may be used as a blistering agent in cases in which there is difficulty in controlling the patient.

**Contraindications.**—Vesicants must be used with the greatest caution in very young, old, or debilitated subjects, as they may occasion sloughing. For the same reason they should be avoided in patients with diabetes. When there is active nephritis, some other irritant than cantharides should be selected.

## SINAPIS ALBA, U. S. P., AND SINAPIS NIGRA, U. S. P.

(White Mustard and Black Mustard.)

White mustard is the seed of *Sinapis alba*, and black mustard is the seed of *Brassica nigra*. Both of these herbs are

largely cultivated in Europe and America. The *mustard* sold as a condiment is a mixture of powdered white and black mustard, often more or less adulterated.

White mustard contains a ferment, *myrosin*, and a glucosid, *sinalbin*. In the presence of water the ferment acts upon the glucosid and separates from it an acrid fixed oil—*acrinyl sulphocyanate*. Black mustard also contains myrosin, and this ferment, in the presence of water, acts upon another constituent, *sinigrin*, separating from it an intensely irritant volatile oil —*allyl isosulphocyanate*.

PREPARATIONS.

Charta Sinapis, U. S. P. (paper spread with a mixture of powdered and purified black mustard and an India-rubber solution).
Oleum Sinapis Volatile, U. S. P. (distilled from a mixture of powdered black mustard and water).

**Physiologic Action and Therapeutics.**—Mustard made into a paste with water and applied to the skin causes redness, heat, and burning pain, and, if the contact be prolonged, vesication. As the blisters produced by mustard are healed with difficulty, the drug is used externally only as a rubefacient. Applied in the form of a plaster (*sinapism*) or of the official paper, it often affords much relief in various painful affections, such as *bronchitis*, *cerebral congestion*, *headache*, *intestinal colic*, *gastritis*, *muscular rheumatism*, and *neuralgia*. A plaster may be made by spreading between two layers of thin muslin a paste made by mixing ordinary mustard and flour, equal parts, with warm water. Hot water should not be used, since high temperature destroys the ferment required to evolve the irritant oil from the glucosid. Such a plaster should be left on from twenty to thirty minutes, or until the skin is quite red. A very mild rubefacient effect may be secured by sprinkling a little mustard on the surface of a flaxseed poultice.

Internally, mustard acts as an irritant emetic, evacuating the stomach promptly and thoroughly. It may be employed in cases of *narcotic poisoning*, the dose being a tablespoonful stirred up in warm water, and repeated, if necessary, in fifteen minutes.

**Thiosinamin** (*Allyl-sulphourea*).—This is a compound produced by acting on the volatile oil of mustard with ammonia. It occurs in colorless, soluble crystals, of bitterish taste and a garlicky odor. The reputed action ascribed to it is the softening of scar tissue. Hebra, Unna, Juliusberg, Crocker and Pernet, and others have recommended it in *keloid*, *post-lupus*

*scarring*, *scleroderma*, *elephantiasis*, and *cicatricial strictures* and *deformities*. It may be given hypodermically every other day, in doses of from 1–2 gr. (0.06–0.13 gm.), dissolved in glycerin and water, or by the mouth in daily doses of 3 gr. (0.2 gm.). Another method of application is by the local use of thiosinamin plasters (10 to 30 per cent.).

Hebra has warned against the use of the drug in all cases of partially healed tuberculous foci.

**Fibrolysin.**—This is a double salt of thiosinamin and sodium salicylate, freely soluble in water. As the solution is unstable it is put up in sealed phials, each of which contains 24 grains (1.5 gm.) of fibrolysin, or the equivalent of 3 grains (0.2 gm.) of thiosinamin.

## ARNICA, U. S. P.

Arnica is official as the flowers of *Arnica montana*, a perennial herb growing in the temperate regions of Europe, Asia, and America. It contains a volatile oil, tannin, and a glucosid, *arnicin*.

| Preparation. | Dose. |
|---|---|
| Tinctura Arnicæ, U. S. P. . . . . | 10–30 min. (0.6–2.0 c.c.). |

**Physiologic Action and Therapeutics.**—Applied to the skin, arnica causes redness and burning, and occasionally very severe erysipelatous inflammation. Internally, according to Hare, moderate doses slow the pulse and raise the blood-pressure. Toxic doses cause gastro-intestinal irritation, a feeble pulse, profound prostration, and, sometimes, delirium and stupor.

Arnica, in the form of the tincture, has been used very largely as a stimulant application in *sprains* and *bruises*. Internally, it has been recommended in a variety of diseases, but there is little evidence to show that it is of value in any one of them.

## CHRYSAROBINUM, U. S. P.

(Chrysarobin.)

Chrysarobin is a neutral principle, more or less impure, obtained from *goa powder*, a substance found in the wood of *Vouacapoua Araroba*, a large tree growing in the forests of Brazil. It is a yellow, crystalline powder, odorless and tasteless, and very slightly soluble in water, alcohol, chloroform,

or ether. On exposure to air it turns brownish, owing to partial oxidation into chrysophanic acid.

PREPARATION.

Unguentum Chrysarobini, U. S. P. (6 per cent.).

**Physiologic Action and Therapeutics.**—Chrysarobin is a local irritant and a parasiticide. Internally, large doses cause gastro-enteritis and nephritis. It is eliminated chiefly by the kidneys, partly as chrysophanic acid and partly unchanged.

Although it stains the skin temporarily and the clothing permanently, and, in some persons, causes severe dermatitis, chrysarobin is probably the most efficient remedy we have in *psoriasis*. It is adapted to cases in which the patches are comparatively few and large, or to the large patches in extensive cases (Stelwagon). If used too freely, it may be absorbed and give rise to untoward symptoms. As the conjunctiva is exceedingly sensitive to its irritant effect, it should not be employed about the face. It may be prescribed in an ointment, 10–60 gr. (0.65–4.0 gm.) to the ounce (30.0 c.c.); suspended in chloroform, 1–2 dr. (4.0–8.0 gm.) to the ounce (30.0 c.c.); or suspended in collodion, 30–60 gr. (2.0–4.0 gm.) to the ounce (30.0 c.c.). When the infected areas are small, chrysarobin may be applied with advantage also in *ringworm*, either of the body or of the scalp.

## OLEUM CADINUM, U. S. P.

(Oil of Cade; Juniper Tar Oil.)

Oil of cade is a volatile oil distilled from the wood of *Juniperus Oxycedrus*, a shrub resembling the common juniper and growing in Southern Europe. It is a thick, dark-brown liquid having a tarry odor and taste. It is completely soluble in ether or chloroform and partially so in alcohol.

**Therapeutics.**—The action of oil of cade is very similar to that of the oil of tar. The drug is chiefly used as a stimulant application in *psoriasis* and *chronic eczema*. It may be prescribed in ointment, 1–3 fl. dr. (4.0–11.0 c.c.) to the ounce (30.0 gm.), or as a pigment made by diluting the oil with one or two parts of alcohol.

## OLEUM GYNOCARDIÆ.

(Oil of Gynocardia; Chaulmoogra Oil.)

Chaulmoogra oil is an acrid, whitish fat obtained from the seed of *Gynocardia odorata*, a native of the East Indies. Its

activity is believed to be due to *gynocardic acid*. It has
used with asserted good results, both internally and extern
in *leprosy*. The dose is from 10–30 min. (0.6–2.0 c.c.) in
sules or in emulsion. Externally, it is prescribed by inunc
a 50 per cent. ointment being thoroughly rubbed into
affected parts for an hour or two daily. It has been empl
also to some extent as a local stimulant in *sprains* and *br*

## BALSAMUM DIPTEROCARPI.

(Balsam of Dipterocarpus; Gurjun Balsam; Wood Oil.)

Gurjun balsam is an oleoresin obtained by incising *Di*
*carpus turbinatus* and other species of *Dipterocarpus*,
trees growing in India and the East Indies. It conta
volatile oil, gurjunic acid, and resin. It has been used la
to adulterate the oleoresin of copaiba, which it resembles
closely in its properties. It is said to be of value, both
internal remedy and as a local application in *leprosy*.
dose is from 10–40 min. (0.6–2.5 c.c.), in emulsion. Exter
it is applied by inunction, diluted with from 1 to 3 parts of
water or olive oil.

## OTHER COUNTERIRRITANTS.

**Oil of Turpentine** (see p. 236).—In the form of a s
oil of turpentine makes an excellent rubefacient applicati
a large number of affections attended with pain or irrit
such as *muscular rheumatism*, *intestinal colic*, *gastralgia*,
*chitis*, and *pulmonary congestion*. Turpentine liniment ap
with friction is useful in *muscular rheumatism*, *chronic art*
*rheumatism*, and *chilblain*.

**Iodin** (see p. 317).—As a counterirritant, iodin is
adapted to conditions requiring a mild but persistent
The tincture applied as a pigment is extensively employ
such affections as *laryngitis*, *pleurisy*, *synovitis*, *arthritis*,
*ritis*, *periostitis*, *bubo*, and *chilblain*.

**Capsicum** (see p. 185).—Tincture of capsicum, more o
diluted, may be applied as a lotion in *acute torticollis* and
*blain*. Capsicum plaster is sometimes serviceable in reli
*lumbago* and other *muscular pains*.

**Chloroform** (see p. 123), **Aconite** (see p. 60), **Amm**
(see p. 41), **Camphor** (see p. 132).—These drugs are e
sively employed as rubefacients in the form of linin
They are often combined with advantage, as in the follc
formula:

℞ Tincturæ aconiti,
Chloroformi,
Olei terebinthinæ, aa f℥ss;
Linimenti saponis, f℥iij. M.

## JEQUIRITY.

(Abrus; Prayer Beads.)

Jequirity is the seed of *Abrus precatorius*, a plant growing in India and in Brazil. It contains a toxalbumin known as *abrin*. In the form of a freshly prepared infusion (3 per cent.) it has been used as a local remedy in the treatment of *chronic granular conjunctivitis* and of the *corneal pannus* associated with this disease. Applied to the eye, it produces a severe membranous conjunctivitis which must be controlled by cold compresses. As the treatment is somewhat hazardous, it is rarely employed at the present day except in long-standing cases of trachoma with very dense pannus.

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# ESCHAROTICS OR CAUSTICS.

Escharotics or caustics are agents that corrode or disorganize the tissues. Some, like arsenic, have a specific poisonous action upon the cells; some, like the strong mineral acids, extract water from the tissues and precipitate the proteids; some, like the alkaline hydrates, not only extract water, but dissolve the proteids and form with them soluble compounds; some, like the nitrate of lead, form with the proteids insoluble albuminates, and in so doing also liberate an acid; some, like the nitrate of mercury, poison the cells directly, form albuminates with the proteids, and also set free an acid; while others still, like bromin, are powerful oxidizers of organic matter. The most important escharotics are:

Sulphuric acid.
Nitric acid.
Carbolic acid.
Arsenic trioxid.
Acetic acid.
Trichloracetic acid.
Chromium trioxid (chromic acid).
Lactic acid.
Pyrogallic acid.
Osmic acid.
Bromin.
Potassium hydroxid.
Sodium hydroxid.
Sodium ethylate.
Zinc chlorid.
Mercuric nitrate.
Silver nitrate.
Lead nitrate.

The *actual cautery* (hot iron; Paquelin cautery; galvano-

cautery) also offers a prompt and powerful means of destro tissue.

Escharotics are used to destroy exuberant granulations tissue around poisoned wounds, and small growths, suc warts, epitheliomata, and lupus infiltrations, and also to m the specific character of phagedenic ulcers and sloug wounds.

**Depilatories** are agents employed to remove superf hair. The most important are *barium sulphid* and *ca sulphydrate*. Permanent removal of hair can be effected by *electrolysis*.

## ACIDUM SULPHURICUM, U. S. P.

(Sulphuric Acid; Oil of Vitriol; $H_2SO_4$.)

Official sulphuric acid is a colorless, heavy, oily liquid, less, and of intensely sour taste and acid reaction. It marked affinity for water, with which it mixes with the e tion of heat. It rapidly chars and destroys organic matt

| Preparations. | Dose. |
|---|---|
| Acidum Sulphuricum Dilutum, U. S. P. (contains 10 per cent. of absolute sulphuric acid) | 10–20 min. (0.6–1.2 c.c.) |
| Acidum Sulphuricum Aromaticum, U. S. P. (an alcoholic solution containing about 20 per cent. of the official acid, with ginger and cinnamon) | 5–20 min. (0.3–1.2 c.c.). |

**Physiologic Action.**—When applied to the skin i centrated form, sulphuric acid causes intense pain and a destruction of tissue, the eschar being first white anc brown or black. Upon mucous membranes it has a stil irritant and corrosive effect. The local corrosion result the extraction of water, the neutralization of the alkal the precipitation of albumins. Internally, large doses p burning in the throat and gullet, violent pain in the abc constant vomiting of dark matter, often mixed with blo mucus, intense thirst, difficult breathing, and collapse. usually occurs within twenty-four hours, and if the ac reached the larynx, a fatal termination may result alm mediately from suffocation. Blackish stains on the c may serve as a clue to the recognition of the poison.

Even in very dilute form sulphuric and other minera in large doses, may prove fatal to herbivorous animals b coming the alkalinity of the blood, thereby renderin capable of removing carbonic acid from the tissues. S untoward effect, however, can scarcely occur in carni

animals or in man, since in them the tissues under the influence of the acid yield large quantities of ammonia, which unites with acid, thus protecting the alkalis of the blood from neutralization. Sulphuric acid circulates in the blood in the form of its salts, and is rapidly eliminated in the urine chiefly as acid salts.

**Treatment of Poisoning.**—This consists in administering alkalis,—chalk, magnesia, soap, white-wash, or alkaline carbonates,—together with demulcent drinks, such as albumin-water, milk, or barley-water. Opium is always required to relieve the severe pain. The stomach-pump should be avoided on account of the risk of piercing the softened esophagus.

**Therapeutics.**—Sulphuric acid, owing to the severity of its action, is less useful as an escharotic than some of the other acids. It is occasionally employed, however, as a caustic in *phagedenic chancroid*, being applied in the form of a paste made by mixing the acid with some indifferent substance, such as charcoal or asbestos. It has been used also to a limited extent in *caries*, to hasten the removal of the diseased bone.

Internally, in the form of aromatic sulphuric acid, it is sometimes of service as an antihydrotic in the *night-sweats of phthisis*. Combined with opium, it has been recommended in *serous diarrhea*. Sulphuric acid lemonade has been used by workers in lead as a prophylactic against *plumbism*.

**Administration.**—Sulphuric acid should be given well diluted, precautions being taken to prevent its action on the teeth.

**Incompatibles.**—Alkalis, alkaline carbonates, iodids, and salts of lead and of lime. It is explosive with sugar and oil of turpentine. The undiluted acid carbonizes syrups.

## ACIDUM NITRICUM, U. S. P.

(Nitric Acid; $HNO_3$.)

The official nitric acid is a colorless, intensely acid, fuming liquid composed of 68 per cent. of absolute nitric acid and 32 per cent. of water.

| Preparations. | Dose. |
|---|---|
| Acidum Nitricum Dilutum, U. S. P. (10 per cent. by weight of absolute nitric acid) | 5–20 min. (0.3–1.2 c.c.). |
| Acidum Nitrohydrochloricum, U. S. P. (aqua regia: nitric acid, 18; hydrochloric acid, 82) | 2–4 min. (0.1–0.25 c.c.). |
| Acidum Nitrohydrochloricum Dilutum, U. S. P. (nitric acid, 4; hydrochloric acid, 18; water, 78) | 5–20 min. (0.3–1.2 c.c.). |

**Physiologic Action and Therapeutics.**—Locally, pure nitric acid is a powerful caustic, but somewhat less painful and less penetrant than sulphuric acid. It stains the skin yellow. In overdoses it produces symptoms and lesions (except the yellow coloration) similar to those produced by sulphuric acid, and in poisoning the same treatment is applicable.

As an escharotic, nitric acid is generally preferred to other mineral acids, as its action is more readily controlled. It has been found reliable in *phagedenic ulcers*, *chancroids*, and *chancres*, and in *hospital gangrene*. It has been used very successfully also, when milder measures have failed, as a means of producing inflammatory contractile tissue in *prolapse of the rectum* occurring in children.

Internally, dilute nitric acid has been recommended by Ringer and others in *indigestion*, especially when eructation of offensive gas is a prominent symptom, or when there is a tendency to persistent aphthous stomatitis. It should be taken well diluted through a glass tube.

**Incompatibles.**—Alkalis, carbonates, oxids, lead acetate, and iron sulphate. The strong acid forms explosive compounds with readily oxidizable substances, such as glycerin, alcohol, phenol, resins, volatile oils, etc.

**Nitrohydrochloric Acid.**—This is a yellow, fuming, corrosive liquid produced by mixing nitric acid with hydrochloric acid. Both acids undergo decomposition with the formation of nitrosyl chlorid (NOCl) and chlorin. Nitrohydrochloric acid is believed to have a special action on the liver; whether this be true or not, the drug is often of value in that form of *indigestion* which culminates at frequent intervals in so-called *bilious attacks*. It has a well-deserved reputation also in *malassimilation* manifested by gaseous eructations, great mental depression, and persistent oxaluria. The best results are obtained by using the strong acid, freshly prepared, though considerable care must be exercised in handling it. It should be taken after meals, well diluted, through a tube. It should not be prescribed undiluted with tinctures or other alcoholic preparations, as such mixtures are liable to explode.

Nitrohydrochloric-acid baths were formerly employed rather extensively in various affections of the liver, but it is doubtful whether they exerted any influence beyond a beneficial stimulation of the skin. Nitrohydrochloric acid is not used as an escharotic.

## ACIDUM ACETICUM.

(Acetic Acid; $HC_2H_3O_2$.)

Acetic acid is official in the following forms:

Acidum Aceticum, U. S. P. (36 per cent. by weight of absolute acetic acid).
Acidum Aceticum Dilutum, U. S. P. (6 per cent. by weight of absolute acetic acid).
Acidum Aceticum Glaciale, U. S. P. (nearly absolute acetic acid).

Vinegar (*acetum*) is not official, but has the same therapeutic value as diluted acetic acid.

**Physiologic Action and Therapeutics.**—Locally applied, concentrated acetic acid produces redness, vesication, and ultimately superficial sloughing. Taken internally, it causes severe gastritis. Even small doses of acetic acid, if long continued, cause chronic gastric catarrh. It is eliminated as carbonates, so it does not increase the acidity of the urine.

Glacial acetic acid is sometimes employed to remove *warts* and *corns*. Inhalations of diluted acetic acid or of vinegar are often useful in checking vomiting occurring after general anesthesia. Vinegar is of service as a local hemostatic in *epistaxis*, *leech-bites*, and *small wounds*, as well as in *postpartum hemorrhage*. In the form of an enema it is occasionally employed to destroy *oxyures*. Internally, it may be used as an antidote in *poisoning by alkalis*.

## ACIDUM TRICHLORACETICUM, U. S. P.

(Trichloracetic Acid; $HC_2Cl_3O_2$.)

Trichloracetic acid is formed by acting on glacial acetic acid with chlorin or on hydrated chloral with fuming nitric acid. It occurs in colorless, hygroscopic crystals, of pungent odor and strong acid reaction.

**Therapeutics.**—Pure or in concentrated solution, trichloracetic acid has been used to some extent as a caustic for removing small growths, such as *venereal* or *cutaneous warts*, *nevi*, and *corns*. A solution of from 5 to 10 per cent. makes an excellent stimulant application in *chancroids*, *mucous patches*, *tuberculous ulcers*, and *fistulous tracts*. In this strength it causes but little pain or inflammatory reaction.

## CHROMII TRIOXIDUM, U. S. P.

(Chromium Trioxid; Chromic Acid; Chromic Anhydrid; $CrO_3$.)

Chromium trioxid, or so-called chromic acid, occurs in crimson, deliquescent crystals, odorless, and readily soluble in

water. With organic matter, alcohol, glycerin, ether, ta
sugar, etc., it is explosive.

**Physiologic Action and Therapeutics.**—Owing t
strong oxidizing power chromic acid is an energetic ca
slower and somewhat less painful in its action, however,
nitric acid, potassa, or silver nitrate. Internally, it is an a
poison, producing severe abdominal pain, vomiting, pur
albuminuria, and collapse. The vomited matters are ofte
a green or bluish-green color. The postmortem lesions
sist in inflammation and erosion of the gastro-intestinal
cous membrane, nephritis, and fatty degeneration of the tis
especially of the liver. Alkalis neutralize the acid, but as
form poisonous salts, the stomach should be thoro
emptied after their administration. The local application
halation of chromium compounds may also result in poisc
Workers in these preparations not infrequently suffer fro
cerations of the skin and mucous membranes, chronic
chitis, and interstitial nephritis.

Chromic acid may be used to destroy small growth
*common warts*, *venereal warts*, and *corns*. For this pur
may be applied in substance or in strong solution—2–3 dr
12.0 gm.) to the ounce (30.0 c.c.). The fused acid on a
may also be employed successfully in removing *soft*
*trophies* of the nasopharyngeal mucous membrane and i
ing small *salivary fistulæ*. A solution of from 20–30 gr
2.0 gm.) to the ounce (30.0 c.c.) makes an excellent stir
application in *mucous patches*. A solution of 40 gr. (2.6 g
the ounce (30.0 c.c.), applied once a week, has been we
ommended in *hyperidrosis* and *bromidrosis of the feet*.

**Potassium Dichromate.**—This salt, in doses o
$\frac{1}{12}$–$\frac{1}{10}$ gr. (0.005–0.0065 gm.), has been used with good
by Frazer, Bradbury, White, and others in *chronic*
*catarrh* and *gastric ulcer*. It should be given in capsule
pills made with kaolin, thrice daily, on an empty stoma

## ACIDUM LACTICUM, U. S. P.

(Lactic Acid; $HC_3H_5O_3$.)

Lactic acid is an organic acid usually obtained by sub
milk-sugar or grape-sugar to lactic fermentation. The
preparation is composed of 75 per cent. by weight of a
lactic acid and 25 per cent. of water.

**Therapeutics.**—Lactic acid, in solutions of from 20
per cent., is a valuable application in *tuberculous* and
*ulcerations of mucous membranes*. In the proportion o

of the acid to from 5–20 parts of water it sometimes proves efficacious in *freckles* and *chloasma*.

## PYROGALLOL, U. S. P.

(Pyrogallic Acid; $C_6H_3(OH_3)$.)

Pyrogallic acid is produced by the action of heat on gallic acid. It occurs in white, lustrous needles or scales, odorless, and of a bitter taste. It is readily soluble in water, alcohol, or ether.

**Physiologic Action and Therapeutics.**—Locally, pyrogallol is an irritant or caustic, according as it is applied in dilute or in concentrated form. It is also an active parasiticide. It stains the skin a brownish color. As a caustic its action is slow and attended with but little pain. Owing to its power to destroy the red blood-cells and to convert hemoglobin into methemoglobin, grave, or even fatal, toxic effects may result from the application of the drug over too large a surface.

Pyrogallol is an efficient caustic in *lupus* and *epithelioma*, when the lesions are small. It is generally applied in the form of an ointment, from 20–40 per cent. in strength. Stelwagon recommends the following formula:

℞ Pyrogallol, ʒij–iij (8.0–12.0 gm.);
Cerati resinæ,
Petrolati, aa q. s. ad ℥j (31.0 gm.). M.

Such an ointment should be applied on lint, and renewed twice a day for two or three weeks, the superficial sloughs being removed every few days by poulticing or gentle scraping.

An ointment containing from 20–60 gr. (1.3–4.0 gm.) of pyrogallol to the ounce (31.0 gm.) is sometimes useful in *psoriasis*.

## ACIDUM OSMICUM.

(Osmic Acid; Osmium Tetroxid; $OsO_4$.)

Osmic acid occurs in yellow, crystalline needles, having a pungent odor and a burning taste. It is readily soluble in water, alcohol, or ether.

**Therapeutics.**—Even in weak solution, it is exceedingly irritant and caustic. Stekoulis, Schapiro, Bennett, and others claim excellent results from injections of osmic acid in *neuralgia*. The nerve having been exposed by a small incision, a 1.5 per cent. solution, freshly prepared, is injected into it at several points, to the amount of from 5–10 min. (0.3–0.6 c.c.). The blood and tissues are stained intensely black by the acid,

but healing of the wound is said to proceed rapidly without suppuration.

## BROMUM, U. S. P.

(Bromin; Br.)

Bromin is a non-metallic element obtained from sea-water. It is a dark, reddish-brown liquid, evolving, even at ordinary temperatures, suffocating and irritating fumes. It is soluble in 28 parts of water and readily soluble in alcohol or ether.

**Physiologic Action and Therapeutics.**—Bromin is an intensely active and painful escharotic. It is also a disinfectant and deodorant. When ingested, it causes inflammation and extensive necrosis of the gastro-intestinal mucosa. Inhaled, it acts like chlorin, producing mucopurulent bronchitis, edema of the lungs, and foci of catarrhal pneumonia.

Bromin has been used as an escharotic in *phagedenic* and *cancerous ulcerations*, but, owing to the difficulty in handling it and the great pain caused by its application, it is rarely employed at the present time. It is still occasionally used in very weak solutions as a *deodorant* (see p. 414).

**Bromipin.**—This preparation is an addition-product of sesame oil and bromin (10 per cent.). It is a yellowish, oily liquid, free from the caustic properties of bromin. In daily doses of from 1–3 fl. dr. (4.0–11.0 c.c.) it has been used with asserted good results as a substitute for the bromids in *epilepsy*.

## POTASSII HYDROXIDUM, U. S. P.

(Potassium Hydroxid; Caustic Potash; KOH.)

Caustic potash occurs in hard white pencils or fused masses, odorless, deliquescent, strongly alkaline, and corrosive. It is soluble in 0.4 part of water and in 2 parts of alcohol.

| Preparation. | Dose. |
|---|---|
| Liquor Potassii Hydroxidi, U. S. P. (5 per cent.) . . | 5–30 min. (0.3–2.0 c.c.). |

**Physiologic Action and Therapeutics.**—In concentrated form, potassium hydroxid is a diffusive and deeply penetrating escharotic. Its action is rapid and painful. It produces a grayish, soft, and pultaceous slough, which separates in a few days, leaving an ulcer. Its caustic properties are due to the power of its hydroxyl molecule to abstract water from the tissues, to soften and dissolve them, and to form with the pro-

teids a soluble alkaline albuminate. When swallowed in strong solution it produces all the symptoms of a violent corrosive poison—burning in the throat and gullet, intense abdominal pain, vomiting and purging of mucous and bloody matter, dysphagia, hoarseness, and collapse. If recovery follows, stricture of the esophagus or cicatricial contractions of the stomach may result from the extensive ulceration.

Small doses, in dilute solution, exert an influence similar to that of the alkaline carbonates (see Gastric Antacids). The drug is eliminated as a carbonate, chiefly in the urine.

**Treatment of Poisoning.**—This consists in neutralizing the alkali with a weak acid, such as vinegar or lemon-juice, and in allaying the irritation and pain with demulcents and opium.

As an escharotic, caustic potash may be used to remove *common warts* and small *cutaneous cancers*. For this purpose the solid stick should be used, the surrounding parts being protected by a coating of oil. When the desired effect has been attained, further action may be prevented by the application of vinegar. Caustic potash is also an efficient agent with which to cauterize the *bites of rabid animals*. In *ingrowing toe-nail*, the insertion under the nail of a pledget of cotton soaked in liquor potassii hydroxidi (1 part to 4 parts of water) affords an excellent means of removing the redundant tissue, thus facilitating the raising of the nail. The diffusive action of potassium hydroxid renders it unsuitable for use on mucous membranes.

A mixture of equal parts of potassium hydroxid and lime (*Vienna paste*) being less deliquescent than pure caustic potash, is more manageable than the latter, but slower in its action.

Internally, solution of potassium hydroxid, well diluted, is rarely used as an *antacid*.

**Incompatibles.**—Acids, acid salts, metallic salts, and alkaloids.

## SODII HYDROXIDUM, U. S. P.

(Sodium Hydroxid; Caustic Soda; NaOH.)

Caustic soda occurs in white, translucent pencils or fused masses, odorless, of an acrid, caustic taste and an intensely alkaline reaction. It is readily soluble in water and in alcohol.

| Preparation. | Dose. |
|---|---|
| Liquor Sodii Hydroxidi, U. S. P. . . . . | 5–30 min. (0.3–2.0 c.c.). |

**Therapeutics.**—Caustic soda may be used for the same purposes as caustic potash, the action of the two drugs being similar.

## SODII ETHYLAS.

(Sodium Ethylate; Sodium Alcohol; $NaC_2H_5O$.)

A solution of sodium ethylate, made by dissolving 1 part of metallic sodium in 20 parts of absolute alcohol, has been used, on the recommendation of B. W. Richardson, as a caustic to remove *vascular nevi* and *warts*. It should be applied with a glass rod, and the superficial dry crust formed allowed to come off spontaneously. It is said to cause less scarring than other caustics. It is decomposed by water.

## BARII SULPHIDUM.

(Barium Sulphid; BaS.)

Barium sulphid is an amorphous, pale yellow, phosphorescent powder, soluble in water. Diluted with from 1 to 3 parts of some inert powder, it is used as a *depilatory*. Duhring recommends:

℞ Barii sulphidi, ʒj–ij (4.0–8.0 gm.);
Amyli,
Zinci oxidi, āā ʒiss (6.0 gm.). M.

At the time of application sufficient water is added to make a paste, which is thickly spread over the affected part and allowed to remain for a minute or two or until it excites slight burning.

Barium sulphid deteriorates with age and on exposure to air.

## CALCII SULPHIDUM HYDRATUM.

(Hydrated Calcium Sulphid; Calcium Sulphohydrate; $CaS + H_2O$.)

Hydrated calcium sulphid is a whitish or pale-pink powder, made by heating together at a high temperature calcium sulphate and granulated wood-charcoal. In the form of a paste it has been recommended by Kaposi, Brayton, and others as a harmless *depilatory*. When wetted, it gives off hydrogen sulphid, which is sometimes a drawback to its use.

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## OTHER ESCHAROTICS.

**Arsenic Trioxid** (see p. 305).—Arsenic is a slowly acting ıt deeply penetrating escharotic. It causes severe pain and nsiderable inflammatory swelling, and, if applied over too large urface, may prove dangerous through absorption. On the ıer hand, its action, while very thorough, is largely limited to

the diseased tissue. Its *modus operandi* is not definitely known, but as it does not combine chemically with the tissues, it is supposed to act directly upon the cells in a specifically poisonous manner. The employment of arsenic as an escharotic is practically confined to the removal of *small cutaneous cancers* and *lupus infiltrations* (see p. 309) and the destruction of the *pulp in carious teeth.*

**Carbolic Acid** (see p. 387).—Carbolic acid is a comparatively superficial escharotic, the deeper tissues being protected by an albuminous coagulum. Owing to the property which it possesses of paralyzing the peripheral sensory nerves, its application is not followed by very severe or persistent pain. Absolute alcohol, as Phelps and Powell have shown, destroys its caustic action. After thorough curetment of the parts pure liquid carbolic acid may be applied with advantage in *inflammatory gangrene, irritable ulcers, carbuncles,* and *fistulæ.* Local injections of the pure acid are also efficacious in *anthrax* (see p. 389). Von Bruns claims excellent results in the treatment of *infected wounds* from the application of pure carbolic acid in small quantities and for one minute, followed immediately by irrigation with absolute alcohol.

**Mercuric Nitrate** (see p. 332).—This salt is an exceedingly irritant and powerful escharotic. Its action depends upon several factors: (1) The union of the metal with the proteids to form a soluble albuminate; (2) the liberation of nitric acid, which is also caustic; and (3) the toxic effects upon the cells of the mercury itself. As an escharotic it has been extensively employed in the form of the solution of mercuric nitrate in *phagedenic venereal sores.* If used too freely, it is liable to be absorbed and to induce salivation.

**Zinc Chlorid** (see p. 369).—This salt is an energetic and very painful caustic. It produces a dry, whitish slough, the separation of which usually requires from one to three weeks. Unlike arsenic, it does not spare the healthy tissue. In the form of a paste to which cocain has been added, it is sometimes used to remove *cutaneous epitheliomata.*

**Silver Nitrate** (see p. 370).—The insoluble and impenetrable pellicle of silver albuminate which lunar caustic immediately forms when brought in contact with the tissues confines its destructive action to the superficial cells. In the form of the solid stick it is an excellent caustic for removing such formations as *small warts, mucous patches,* and *exuberant granulations.*

**Lead nitrate** (see p. 365).—The corrosive action of this salt of lead is due largely to the nitric acid which is liberated

when it is brought in contact with proteid matter. It is so
times used in the form of a powder as a caustic in *onychia*.

## PROTECTIVES.

Protectives are agents that serve to protect inflamed or inju
surfaces from external irritation. Their action is chi
mechanical. Those of a mucoid or colloid nature, which e
a soothing effect upon inflamed parts, are known as **dem
cents.** The most important members of this subdivision

| | |
|---|---|
| Flaxseed. | Marshmallow. |
| Acacia. | Licorice root. |
| Tragacanth. | Almond. |
| Sassafras pith. | Starch. |
| Slippery elm. | White and yolk of egg. |

Internally, demulcents are especially useful in protecting
walls of the stomach from the action of corrosive pois
Made up into lozenges and allowed to dissolve slowly in
mouth they tend to subdue pain and cough resulting
irritation of the throat. In the form of enemata, they are
to relieve the tenesmus of acute dysentery. Externally
are rarely employed except in the form of poultices, and
in this form they are used more as a means of applying
and moisture than as protectives. Hot poultices are very
cacious in relaxing local spasms, such as occur in asthma
the various forms of colic. In deep-seated inflammatio
pneumonia, nephritis, cystitis, etc.—they usually afford
siderable comfort, and no doubt exert a reflex influence on
morbid process itself (see Counterirritants). In superficia
flammations hot antiseptic fomentations have largely suppla
ordinary poultices, because the latter afford such excel
media for the growth of bacteria. When suppuration
already occurred or is obviously inevitable, poultices are wh
inadmissible.

Protectives of a fatty character, intended to shield the
from external irritants and at the same time to soften and r
it, are known as **emollients.** The most important are:

| | |
|---|---|
| Lard. | Almond oil. |
| Suet. | Linseed oil. |
| Wool-fat. | Petrolatum. |
| Spermaceti. | Glycerin. |
| Olive oil. | Wax. |

Emollients are used for their protective and soothing properties in burns, in fissuring of the lips and hands, and in acute inflammatory diseases of the skin. They are also extensively employed as bases for special ointments.

The so-called **dusting-powders** constitute another group of protectives. The requisites of a good dusting-powder are dryness, insolubility, inertness, and absolute freedom from grittiness. Those in common use are:

| | |
|---|---|
| Starch. | Zinc oxid. |
| Talc. | Chalk. |
| Kaolin. | Magnesium carbonate. |
| Lycopodium. | |

Dusting-powders are prescribed in various forms of erythema and in acute eczema to protect the parts from air, moisture, and friction.

Finally, certain protectives which have strong adhesive properties and can be kept in place for several days without change are employed as **fixed dressings.** In this class are:

| | |
|---|---|
| Collodion. | Solution of gutta-percha. |

Lead plaster (*Emplastrum Plumbi*, U. S. P.), adhesive or rubber (*Emplastrum Adhæsivum*, U. S. P.), and soap plaster (*Emplastrum Saponis*, U. S. P.) also belong in this group.

Fixed dressings are frequently of service in the treatment of abrasions, small wounds, fissures, and bed-sores.

## LINUM, U. S. P.

(Linseed; Flaxseed.)

Linseed is the seed of *Linum usitatissimum*, or common flax, an annual cultivated in all temperate countries. From a therapeutic standpoint its chief ingredients are a mucilaginous principle and a fixed oil.

PREPARATIONS.

Oleum Lini, U. S. P.
Linimentum Calcis, U. S. P. (Carron-oil: equal parts of linseed oil and lime-water).
Sapo Mollis, U. S. P. (soft or green soap).
Linimentum Saponis Mollis, U. S. P. (tincture of green soap: soft soap, 65; oil of lavender, 2; alcohol to make 100).
Liquor Cresolis Compositus, U. S. P.

**Therapeutics.**—An infusion or tea of flaxseed serve an excellent *demulcent drink*. Ground flaxseed is the mat most commonly selected for making ordinary *poultices*. soap and liniment of soft soap are used for detergent purp and also for removing *crusts* and *scales* in sluggish disease the skin like seborrhea and psoriasis.

## ACACIA, U. S. P.

(Gum Arabic.)

Acacia is a gummy exudation obtained from *Acacia Sen* a small tree growing in Senegal, Kordofan, and Abyssinia contains *arabic acid* in combination with calcium, magnes and potassium.

| Preparations. | Dose. |
|---|---|
| Mucilago Acaciæ, U. S. P. . . . . | Indefinite. |
| Syrupus Acaciæ, U. S. P. . . . . | Indefinite. |
| Pulvis Cretæ Compositus, U. S. P. . . . . | 5–60 gr. (0.3–4.0 gm.). |

Acacia also enters into chalk mixture, compound mi of glycyrrhiza, emulsion of almond, emulsion of cod-live emulsion of cod-liver oil with hypophosphites, emulsion of turpentine, and several troches and pills.

**Therapeutics.**—In therapeutics acacia is used chiefly *demulcent;* in pharmacy it is used for holding togethe active ingredients in pills and lozenges and for suspen insoluble substances in water. It is precipitated from its tion by alcohol, subacetate of lead, ferric salts, and borax

## TRAGACANTHA, U. S. P.

(Tragacanth.)

Tragacanth is a gummy exudation from *Astragalus mifer*, a shrub growing in western Asia. It contains *tra thin* or *bassorin* and the *calcium salt of gummic acid*. It s up in water into a gelatinous mass, but, unlike acacia, doe dissolve in it.

Preparation.

Mucilago Tragacanthæ, U. S. P.

Tragacanth also enters into emulsion of chloroform most of the official troches.

**Therapeutics.**—On account of its insolubility, it is r used as a demulcent. It is employed in pharmacy for pending resins, oils, and heavy powders in water.

## SASSAFRAS MEDULLA, U. S. P.

(Sassafras Pith.)

Sassafras pith is obtained from the branches of *Sassafras variifolium*, a tree growing in the woods of North America.

PREPARATION.

Mucilago Sassafras Medullæ, U. S. P.

**Therapeutics.**—The mucilage has demulcent properties, but it is rarely used except in domestic medicine.

## ULMUS, U. S. P.

(Slippery Elm.)

Slippery elm is the inner bark of *Ulmus fulva*, a large tree growing in the Eastern States of North America. It contains a large quantity of mucilaginous matter.

PREPARATION.

Mucilago Ulmi, U. S. P.

**Therapeutics.**—The powdered bark is sometimes used instead of flaxseed meal for making small *poultices*. In the form of lozenges it is sometimes employed for its soothing properties in *pharyngitis*.

## ALTHÆA, U. S. P.

(Marshmallow.)

Marshmallow is the root of *Althæa officinalis*, a perennial herb growing in most temperate countries. It contains a large amount of mucilage and of starch. It is an ingredient of blue-mass, pills of phosphorus, and pills of carbonate of iron.

**Therapeutics.**—Although it is an agreeable demulcent, marshmallow is rarely prescribed at the present time.

## GLYCYRRHIZA, U. S. P.

(Licorice Root.)

Glycyrrhiza is the root of *Glycyrrhiza glabra*, or *Glycyrrhiza glandulifera*, a perennial herb growing in southern Europe and western Asia and cultivated in England and the United

States. It contains a glucosid, *glycyrrhizin*, to which it c its sweet taste.

| Preparations. | Dose. |
|---|---|
| Extractum Glycyrrhizæ, U. S. P. . . . . | Indefinite. |
| Extractum Glycyrrhizæ Purum, U. S. P. . . | Indefinite, |
| Glycyrrhizinum Ammoniatum, U. S. P. . . | 5–15 gr. (0.3–1.0 gm.). |
| Fluidextractum Glycyrrhizæ, U. S. P. . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Mistura Glycyrrhizæ Composita, U. S. P. (brown mixture: Pure extract of licorice, 3; syrup, 5; acacia, 3; paregoric, 12; wine of antimony, 6; spirit of nitrous ether, 3; water to make 100) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c. |
| Pulvis Glycyrrhizæ Compositus, U. S. P. (glycyrrhiza, 23.6; senna, 18; washed sulphur, 8; fennel oil, 0.4; sugar, 50) . . | ½–2 dr. (2.0–8.0 gm.). |
| Trochisci Glycyrrhizæ et Opii, U. S. P. (each contains extract of glycyrrhiza, 2½ gr.—0.15 gm.—and powdered opium, $\frac{1}{12}$ gr.—0.005 gm.). | |

Glycyrrhiza also enters into aromatic fluid extract of ca sagrada, compound fluid extract of sarsaparilla, comp syrup of sarsaparilla, tincture of aloes, tincture of aloes myrrh, mass of mercury, pills of ferrous iodid, comp laxative pills, troches of ammonium chlorid, and troche cubeb.

**Therapeutics.**—Licorice is a popular remedy for a resulting from irritation of upper respiratory tract. It is largely employed to cover the disagreeable taste of other m cines.

## AMYGDALA.

(Almond.)

Almonds are official in two forms: bitter almonds (*A dala Amara*, U. S. P.) and sweet almonds (*Amygdala D* U. S. P.). Both varieties contain a *fixed oil* and a fer *emulsin*. Bitter almonds contain also a glucosid, *amyg* which, in the presence of water, is acted upon by the e sin and broken up into hydrocyanic acid, benzaldehyd, glucose. Oil of bitter almond (*Oleum Amygdalæ An* U. S. P.) is a loose combination of hydrocyanic acid (2.( per cent.) and benzaldehyd (85 per cent.), obtained by tillation. As sweet almonds do not contain amyg they do not yield hydrocyanic acid when triturated water.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Amygdalæ Amaræ, U. S. P. . . . | ½–1 min. (0.016–0.06 c.c.). |
| Benzaldehydum, U. S. P. (an aldehyd produced artificially or obtained from oil of bitter almond, and having the odor and taste of the latter) . . . . . | ½–1 min. (0.016–0.06 c.c.). |
| Oleum Amygdalæ Expressum, U. S. P. | |
| Aqua Amygdalæ Amaræ, U. S. P. ($\frac{1}{10}$ per cent. of oil of bitter almond) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Spiritus Amygdalæ Amaræ, U. S. P. (1 per cent. of oil of bitter almond) . . . . . | 5–20 min. (0.3–1.2 c.c.). |
| Syrupus Amygdalæ, U. S. P. (1 per cent. of the spirit of bitter almond) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Emulsum Amygdalæ, U. S. P. (6 per cent. of sweet almond) . . . . . | 2–4 fl. dr. (8.0–15.0 c.c.). |
| Unguentum Aquæ Rosæ, U. S. P. (cold cream: spermaceti, 12.5; white wax, 12; expressed oil of almond, 56; stronger rose-water, 19; sodium borate, 0.5). | |

The expressed oil of almond also enters into the emulsion of chloroform and the emulsion of oil of turpentine.

**Therapeutics.**—Almond is nutritive and demulcent. As almond flour contains no starch, it may be used, after the sugar and gum have been extracted from it, as a *diabetic food*. Expressed oil of almond, ointment of rose-water, and emulsion of almond are useful *emollients*. Syrup of almond is employed chiefly as a pleasant vehicle. Oil of bitter almond is an active poison. It was for a time used as a substitute for hydrocyanic acid, but its uncertain composition proved to be a great disadvantage. It is now rarely employed except as a flavoring agent.

## AMYLUM, U. S. P.

(Starch.)

Official starch is the fecula of the seed of *Zea mays*, or Indian corn. Wheat-starch and rice-starch are also used in therapeutics.

PREPARATION.

Glyceritum Amyli.

**Therapeutics.**—Finely powdered starch is much used as an absorbent and protective application in *erythema intertrigo*, or *chafing*. As it readily decomposes in the presence of heat and moisture, boric acid should be added to it as a preservative. The starch poultice, made by mixing starch with cold water and then adding boiling water until the mass is converted into a gelatinous paste, is sometimes employed to remove *crusts* in chronic inflammatory diseases of the skin. Starch-and-lauda-

num enemata, made by adding laudanum to thin starch m
lage, are often efficacious in *acute dysentery* and other *infl*
*matory diseases of the rectum.* Starch is an antidote to *io*
*poisoning.*

## ADEPS LANÆ, U. S. P., and ADEPS LANÆ HYDROSUS, U. S. P.

(Wool-fat and Hydrous Wool-fat; Lanolin.)

Wool-fat is the purified fat of the wool of sheep, freed
water, and hydrous wool-fat is wool-fat mixed with not
than 30 per cent. of water. Both preparations are yello
white, unctuous substances, having a faint peculiar odor.

Hydrous wool-fat enters into belladonna ointment,
monium ointment, ointment of ammoniated mercury, oint
of yellow mercuric oxid, and ointment of red mercuric

**Therapeutics.**—Hydrous wool-fat was introduced by
breich, under the name of lanolin, as a vehicle for ext
medicaments. As an ointment base it is bland and unirrita
does not become rancid, and is miscible with twice its w
of water without losing its ointment-like character; bu
claim that it has greater penetrating power than all othe
is not borne out by experience. Singly, it is an unsatisfa
base, but it sometimes makes a valuable addition to
bases, especially when aqueous substances are to be i
porated.

In certain skin diseases ointments containing water ar
jectionable; in such cases the anhydrous preparation of
fat should be chosen.

## CETACEUM, U. S. P.

(Spermaceti.)

Spermaceti is a concrete fatty substance obtained fro
head of the sperm-whale (*Physeter macrocephalus*). It
in pearly-white, translucent masses, odorless, and of a
mild taste. It is employed chiefly to give proper consi
to cerates and ointments.

PREPARATION.

Unguentum Aquæ Rosæ, U. S. P. (12.5 per cent.).

## OLEUM OLIVÆ, U. S. P.

(Olive Oil; Sweet Oil.)

Olive oil is a fixed oil expressed from the ripe fruit o

*europæa*. It is an ingredient of diachylon ointment and several official oleates.

**Therapeutics.**—Externally, olive oil is a useful emollient. With carbolic acid (5 per cent.) it makes a soothing, protective application for *superficial burns*. In *scarlatina* and *measles* daily inunctions of olive oil are of service in allaying irritation of the skin and in preventing diffusion of the scales. It may be employed to soften *adherent crusts* in such diseases as eczema and seborrhea. Enemata of olive oil (6 to 8 oz.—175.0–235.0 c.c.) are very efficacious in removing *fecal concretions* from the rectum. Internally, its effects are nutritive, demulcent, and feebly laxative. Leube and others have employed, with good results, daily subcutaneous injections of olive oil (2–6 oz.—60.0–175.0 c.c.) as a means of nourishing patients with stricture of the esophagus, but the treatment is not without danger. In one instance, at least, it was the cause of fatal oil-embolism. By some authorities olive oil is held in high repute as a remedy for *gall-stones*, but its value is somewhat doubtful. Five or six ounces (150.0–175.0 c.c.) are given in the attacks of colic, and smaller doses in the intervals. If the drug possesses any efficacy in cholelithiasis, this may depend upon an antispasmodic influence exerted upon the common bile-duct, as Cohnheim has found large doses of the oil very beneficial in *gastrectasis* depending upon *spasm of the pylorus* from ulcer or fissure, and Weill, Duplant, and others have spoken highly of olive oil in *lead-colic*.

## PETROLATUM.

(Paraffin; Cosmolin; Vaselin.)

Petrolatum is a mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the more volatile portions of petroleum and purifying the residue when it has the desired melting-point. Three forms are official: Petrolatum (*Petrolatum*), a yellowish mass, of the consistence of an ointment; white petrolatum (*Petrolatum album*), a white mass, of the consistence of ointment; and liquid petrolatum (*Petrolatum liquidum*), a colorless, transparent, oily liquid.

**Therapeutics.**—Petrolatum is largely used as an emollient and protective dressing and as a substitute for animal and vegetable fats in ointments. It is bland and unirritating, and has little tendency to change. It probably has somewhat less penetrating power than lard.

Subcutaneous and submucous injections of paraffin, as recom-

mended by Gersuny in 1900, have been employed with gratifying results for the correction of various defects and for cosmetic purposes. They have been used successfully in preventing rectal and vaginal prolapse, in relieving incontinence of urine and of feces, in filling depressions caused by the removal of tissue, in correcting nasal deformities, etc. The paraffin should have a melting-point of from 100° to 104° F. (38°–40° C.), should be sterilized by boiling, and should be injected while warm and semisolid. The paraffin is not absorbed, but remains where injected and finally becomes encapsulated.

## GLYCERINUM, U. S. P.

(Glycerin; $C_3H_5(OH)_3$.)

Glycerin is a liquid obtained from fats and fixed oils by saponification with alkalis or by the action of superheated steam. It is colorless, transparent, hygroscopic, without odor, and of a sweet, warm taste and a syrupy consistence. It is freely soluble in water and in alcohol, but insoluble in ether, chloroform, and oils. The dose is from 1–4 fl. dr. (4.0–15.0 c.c.).

| PREPARATIONS. | DOSE. |
|---|---|
| Glyceritum Phenolis, U. S. P. (20 per cent. of phenol). | |
| Glyceritum Acidi Tannici, U. S. P. (20 per cent. of tannic acid). | |
| Glyceritum Amyli, U. S. P. (plasma ; starch, 10; water, 10; glycerin, 80). | |
| Glyceritum Boroglycerini, U. S. P. (50 per cent. of boroglycerin). | |
| Glyceritum Hydrastis, U. S. P. (each cubic centimeter contains 1 gm. of drug). | |
| Suppositoria Glycerini, U. S. P. (each suppository contain 45 gr.—3.0 gm.—of glycerin). | |
| Gelatinum Glycerinatum, U. S. P. (gelatin and glycerin, of each, 100 gm. ; water to make, 200 gm.). | |
| Cataplasma Kaolini, U. S. P. (kaolin, 57.7 parts; boric acid, 4.5 parts; glycerin, 37.5 parts; with small quantities of methyl salicylate, thymol, and oil of peppermint). | |
| Glyceritum Ferri, Quininæ et Strychninæ Phosphatum, U. S. P. . . . . | 10–30 min. (0.6–2.0 c.c.). |

**Physiologic Action.**—Owing to its avidity for water, pure glycerin, when applied to sensitive skin, produces considerable burning and irritation. Internally, in large doses (1 oz.—30 c.c.), it sometimes acts as a cathartic, probably by

abstracting water from the intestinal vessels and also by stimulating peristalsis. In moderate doses glycerin has some nutritive value, inasmuch as it is largely oxidized in the body and protects from combustion fats and carbohydrates. When large amounts are injected directly into the circulation of an animal they cause muscular weakness, thirst, vomiting, hemoglobinuria, a fall in temperature, a rapid, weak pulse, tetanic convulsions, coma, and, finally, death from asphyxia.

Glycerin possesses some power in inhibiting the growth of micro-organisms.

**Therapeutics.**—Externally, glycerin is employed in various forms as an emollient. In the form of an ointment or lotion it is useful in *chapped hands, fissured nipples*, etc. It is highly recommended as a preventive against *bed-sores*. The parts should be bathed twice daily with warm water, carefully dried, and gently rubbed with the glycerin. The official cataplasm of kaolin is a paste of white clay and glycerin. Applied hot, it often makes a good *substitute for the ordinary poultice*. In *inflammatory disease of the mouth, nose, and throat* glycerin makes an excellent vehicle for other drugs. Being hygroscopic, it not only tends to deplete the turgid capillaries, but it also serves to spread the medicament over the entire surface. In *endometritis, uterine congestion*, and *subinvolution* tampons holding glycerin and tannin afford an efficient means of securing local depletion. In the form of a suppository or of an injection (2–3 fl. dr.—8.0–11.0 c.c.—with 1–2 fl. oz.—30.0–60.0 c.c.—of water) it is often employed with advantage to unload the bowel in *simple constipation*.

Glycerin was at one time recommended as a substitute for cod-liver oil in *phthisis* and other *wasting diseases*, but it proved to be of little value. In *diabetes* it may be employed as a sweetening agent instead of sugar, but, as a rule, patients soon tire of it.

In pharmacy glycerin is extensively used as a solvent, an excipient, and a preservative.

**Incompatibles.**—Glycerin is explosive with powerful oxidizing agents like chromic acid and potassium permanganate. Undiluted mixtures of potassium chlorate, tincture of ferric chlorid, and glycerin are liable to explode if warmed.

## TALCUM, U. S. P.

(Talc; Venetian Talc; Magnesium Silicate; Soapstone.)

Talc occurs in grayish-green masses having a waxy luster

and a greasy feel. It is insoluble in acids and other liq
Finely powdered, it is employed as a dusting-powder in
flammatory diseases of the skin, especially in *erythema i*
*trigo* and *acute erythematous eczema*. It is usually prescr
with an antiseptic and an absorbent, as in the following form

| | | |
|---|---|---|
| ℞ | Pulveris talci, | ʒiv (15.5 gm.); |
| | Pulveris acidi borici, | ʒj (4.0 gm.); |
| | Pulveris zinci oxidi, | ʒiij (11.5 gm.). M. |

## KAOLINUM, U. S. P.

(Fuller's Earth; Hydrated Aluminum Silicate.)

Kaolin is a white, impalpable powder, unctuous when r
Like talc, it is inert and unalterable. It is used as a prote
in *inflammatory skin diseases*, sometimes as a dusting-po
but more often in the form of a paste, when ointments
lotions are found to be irritating. Mixed with glycerin,
the official cataplasm of kaolin, and applied hot, it is empl
as a *substitute for poultices*. In pharmacy it is used as a
*basis* for substances readily decomposed, like silver nitrate
potassium permanganate.

## LYCOPODIUM, U. S. P.

Lycopodium is the spores of *Lycopodium clavatum* an
other species of *Lycopodium*, mosses growing in the dry w
of nearly all temperate countries. It is a fine, pale-yellc
powder, mobile, inodorous, and tasteless. It is employe
therapeutics chiefly as a protective and absorbent applic
to *excoriated surfaces*. In pharmacy it is much used to pr
the adhesion of pills, suppositories, etc.

## COLLODIUM, U. S. P.

(Collodion.)

Collodion as a solution of pyroxylin, or gun-cotton (
ether (75) and alcohol (25). It is a colorless, syrupy, h
inflammable liquid, having a strong ethereal odor.

PREPARATIONS.

Collodium Flexile, U. S. P. (collodion, 92; Canada turpentine, 5; cast
oil, 3).

Collodium Stypticum, U. S. P. (tannic acid, 20; alcohol, 5; ether, 2
collodion, to make 100).

Collodium Cantharidatum, U. S. P. (Blistering Collodion: Canthariде
60; flexible collodion, 85; chloroform, to make 100).

**Therapeutics.**—Collodion was introduced into surgery by Schoenbein, in 1846. When applied to an exposed part it quickly dries and forms a thin film, which in shrinking exerts a constricting and compressing effect. It makes a useful protective for *abrasions*, *fissures*, and *aseptic punctures*. It also affords an efficient means of securing antiseptic dressings on small wounds, especially those about the face and scalp. Flexible collodion makes less pressure and cracks less readily than plain collodion. With the addition of a little benzoin it makes an excellent application for *fissured nipples*, *chapped hands*, etc. A mixture of plain collodion and flexible collodion is often employed as a vehicle for such drugs as chrysarobin, pyrogallol, resorcin, etc., in the treatment of certain skin diseases, especially psoriasis, chronic eczema, lupus erythematosus, and ringworm.

Styptic collodion is sometimes applied to small wounds to check capillary oozing. Cantharidal collodion is employed to produce vesication (see p. 440).

### LIQUOR GUTTA-PERCHÆ.

(Solution of Gutta-percha; Traumaticin.)

Solution of gutta-percha is a 9 per cent. solution of gutta-percha in chloroform. It has been used as a substitute for collodion, but it possesses no advantages over the latter.

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## FLAVORING AGENTS.

### LIMON.

(Lemon.)

Lemon is the ripe fruit of *Citrus Limonum*, a tree cultivated in most subtropical countries. The rind contains a *volatile oil*, and the juice, *citric acid*.

| Preparations. | Dose. |
|---|---|
| Limonis Cortex, U. S. P. | |
| Limonis Succus, U. S. P. . . . . | 1–4 fl. oz. (30.0–118.0 c.c.). |
| Oleum Limonis, U. S. P. . . . . | 1–5 min. (0.06–0.3 c.c.). |
| Tinctura Limonis Corticis, U. S. P. . . . | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Acidum Citricum, U. S. P. . . . . | 5–20 gr. (0.3–1.3 gm.). |
| Syrupus Acidi Citrici, U. S. P. (1 per cent.) | 1–4 fl. dr. (4.0–15.0 c.c.). |

The oil of lemon also enters into compound spirit of orange, compound spirit of ammonia, and aromatic elixir.

**Therapeutics.**—Lemon-juice is especially useful in *scurvy*, both as a preventive and a curative agent. Upon what ingredient the antiscorbutic properties of the juice depend has not been determined; they do not appear to depend upon citric acid, however, as other fruits and vegetables in which this acid does not enter are almost equally efficacious. Lemon-juice is believed by some practitioners to be of value also in *acute rheumatism*. In the form of lemonade it makes a pleasant refrigerant drink in *febrile diseases*.

Hamm, Somers, and others have found citric acid of value in preventing the fetid odor of *atrophic rhinitis*. A powder composed of 1 part of the acid with 3 parts of sugar-of-milk is insufflated into the nostrils two or three times daily after the parts have been thoroughly cleansed with an alkaline solution.

All the preparations of lemon are largely used for flavoring purposes.

## AURANTIUM.

(Orange.)

Two varieties of the orange furnish the materials for the official preparations: Bitter orange (*Citrus vulgaris*) and sweet orange (*Citrus Aurantium*).

| PREPARATIONS. | DOSE. |
|---|---|
| Aurantii Amari Cortex, U. S. P. | 15–30 gr. (1.0–2.0 gm.). |
| Fluidextractum Aurantii Amari, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Tinctura Aurantii Amari, U. S. P. | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Aqua Aurantii Florum, U. S. P. | Indefinite. |
| Aqua Aurantii Florum Fortior, U. S. P. | |
| Syrupus Aurantii Florum, U. S. P. | Indefinite. |
| Aurantii Dulcis Cortex, U. S. P. | 15–30 gr. (1.0 2.0 gm.). |
| Tinctura Aurantii Dulcis, U. S. P. | 1–2 fl. dr. (4.0–8.0 c.c.). |
| Syrupi Aurantii, U. S. P. | Indefinite. |
| Oleum Aurantii Corticis, U. S. P. (expressed from the fresh peel of either variety of orange) | 1–5 min. (0.06–0.3 c.c.). |
| Spiritus Aurantii Compositus, U. S. P. (oil of orange-peel, 20; oil of lemon, 5; oil of coriander, 2; oil of anise, 0.5; deodorized alcohol, to make 100) | 1–4 fl. dr. (4.0–15.0 c.c.). |
| Elixir Aromaticum, U. S. P. (compound spirit of orange, 12; syrup, 37.5; deodorized alcohol and water, to make 100) | 1–4 fl. dr. (4.0–15.0 c.c.). |

Bitter orange-peel also enters into compound tincture of cinchona and compound tincture of gentian.

**Therapeutics.**—Bitter orange-peel is a feeble stomachic; but, like the sweet orange, it is employed almost exclusively as a flavoring agent.

## ERIODICTYON, U. S. P.

(Yerba Santa.)

Eriodictyon is the leaves of *Eryodictyon californicum*, an evergreen shrub growing in California. It contains tannin, an acrid, bitter resin, and a trace of volatile oil.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Eriodictyi, U. S. P. . . . | 20–60 min. (1.2–4.0 c.c.). |
| Syrupus Eriodictyi Aromaticus (fluid extract, with compound tincture of cardamom, oil of sassafras, oil of lemon, oil of cloves, potassa solution, alcohol, and syrup) . . . . . | 1–4 fl. dr. (4.0–15.0 c.c.). |

**Use.**—Eriodictyon has been used to some extent as a stimulant expectorant; it is chiefly valuable, however, in the form of the aromatic syrup, to obtund the bitterness of quinin. The aromatic syrup is incompatible with acids.

## SARSAPARILLA, U. S. P.

Sarsaparilla is the root of *Smilax officinalis* and of other species of *Smilax*, climbing evergreens growing in swampy forests in Central and South America. It contains several glucosids of the *saponin* class.

| PREPARATIONS. | DOSE. |
|---|---|
| Fluidextractum Sarsaparillæ, U. S. P. . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Fluidextractum Sarsaparillæ Compositum, U. S. P. (sarsaparilla, 75; glycyrrhiza, 12; sassafras, 10; mezereum, 3; with glycerin, 10; alcohol and water, to make 100) . . . . . | ½–2 fl. dr. (2.0–8.0 c.c.). |
| Syrupus Sarsaparillæ Compositus, U. S. P. (fl. ext. sarsaparillæ, 20; fl. ext. glycyrrhiza, 1.5; fl. ext. senna, 1.5; sugar, 65; oil of sassafras, oil of anise, oil of gaultheria, of each, 0.02; water, to make 100) | 1–4 fl. dr. (4.0–15.0 c.c.). |

**Uses.**—Sarsaparilla has been employed for more than three hundred years as an alterative in *syphilis* and *tuberculosis*, but its beneficial effects in these diseases are very doubtful. It is chiefly useful in the form of the compound syrup as a vehicle for potassium iodid and mercury.

## LAVANDULA.

(Lavender.)

Lavender is the flowers of *Lavandula officinalis*, a shrub indigenous in southern Europe. It contains a volatile oil, tannin, and resin.

| PREPARATIONS. | DOSE. |
|---|---|
| Oleum Lavandulæ Florum, U. S. P. | 1–5 min. (0.06–0.3 c.c.). |
| Spiritus Lavandulæ, U. S. P. | ½–1 fl. dr. (2.0–4.0 c.c.). |
| Tinctura Lavandulæ Composita, U. S. P. (oil of lavender, with oil of rosemary, cinnamon, cloves, nutmeg, and red saunders) | ½–1 fl. dr. (2.0–4.0 c.c.). |

**Uses.**—The preparations of lavender are used solely for their agreeable flavor.

The compound tincture is an ingredient in Fowler's solution.

## ROSA.

(Rose.)

Rose is official as the dried petals of *Rosa gallica*, a species of red rose largely cultivated in western Asia and southern Europe. The chief constituents are a volatile oil, tannin, sugar, and mucilage. The official oil of rose is distilled from the fresh flowers of the Damascus rose (*Rosa damascena*).

PREPARATIONS.

Fluidextractum Rosæ, U. S. P.
Syrupus Rosæ, U. S. P. (12.5 per cent. of the fluid extract).
Mel Rosæ, U. S. P. (12 per cent. of fluid extract in clarified honey).
Confectio Rosæ, U. S. P. (red rose, 8; sugar, 64; honey, 12; stronger rose-water, 16).
Oleum Rosæ, U. S. P. (attar of rose).
Aqua Rosæ Fortior, U. S. P. (water saturated with oil of rose).
Aqua Rosæ, U. S. P. (stronger rose-water and distilled water, equal volumes).

Rose also enters into blue-mass, compound iron mixture, pills of aloes and mastic, pills of aloes and iron, and ointment of rose water.

**Use.**—The preparations of rose are used as agreeable vehicles.

## SACCHARUM, U. S. P. and SACCHARUM LACTIS, U. S. P.

(Cane-sugar or Sugar and Sugar-of-milk or Lactose.)

Cane-sugar is the refined sugar from sugar-cane (*Saccharum*

*officinarum*), from various species of broom-corn (*Sorghum*), and from one or more varieties of sugar-beet (*Beta vulgaris*).

PREPARATION.

Syrupus, U. S. P.

Cane-sugar also enters into the various compound syrups, the various troches, several mixtures, and numerous other preparations. It is employed exclusively as a sweetening agent, a preservative, and a vehicle or excipient.

Sugar-of-milk is the sugar obtained from the whey of cow's milk. It is harder, less soluble, and less sweet than cane-sugar. It is used largely as a diluent for powders. It has some merit also as a diuretic in cardiac dropsy.

## LEVULOSE.

(Fruit-sugar; Fructose.)

Levulose is a saccharine substance found in most sweet fruits, together with grape-sugar, and prepared artificially by hydrolysis from cane-sugar or from inulin, a starchy body contained in inula or elecampane. It occurs as a thick, syrupy liquid or as a coarse, granular powder, and is almost as sweet as cane-sugar. It was recommended by Külz, in 1874, as a sweetening agent and as a carbohydrate food in diabetes. According to Solis-Cohen, Saundby, Tyson, and others, a moderate amount (8–12 dr.—31.0–46.0 gm. daily) can be taken by most patients with impunity.

## BENZOSULPHINIDUM, U. S. P.

(Benzosulphinid; Saccharin.)

Saccharin is a principle prepared from the coal-tar derivative, toluene. It is a light, white, crystalline powder, odorless, and possessing 400–500 times the sweetening power of cane-sugar. It is soluble in 250 parts of water, more so in alcohol and in glycerin, and readily so in alkaline solutions. With solution of sodium bicarbonate it forms a soluble sodium salt, *soluble saccharin*. Saccharin is chiefly useful as a substitute for sugar when the latter is contraindicated, as in diabetes mellitus. Used too freely, it has a retarding influence on digestion and general metabolism. One grain (0.065 gm.) is sufficient to sweeten 4 or 5 ounces (120.0–150.0 c.c.) of tea or coffee.

## MEL, U. S. P.

(Honey.)

Honey is a saccharine fluid prepared by the hive-bee (*Apis mellifera*). It is a mixture of dextrose (grape-sugar) and levulose (fruit-sugar), with minute quantities of wax, formic acid, volatile oil, and coloring-matter.

PREPARATIONS.

Mel Depuratum, U. S. P. (clarified honey).
Mel Rosæ, U. S. P.
Confectio Rosæ, U. S. P.

**Uses.**—Honey is demulcent and feebly laxative, but it is prescribed chiefly as an excipient.

**Wild cherry, licorice, balsam of Tolu,** and many **volatile oils** are also largely used for flavoring purposes.

# REMEDIAL MEASURES OTHER THAN DRUGS.

## ELECTRICITY.

The true nature of electricity is still unknown; like the other great forces of nature, it must be studied in the light of its various manifestations. Gilbert first employed the term to designate the phenomena of attraction and repulsion which result when amber (electrum) and similar substances are briskly rubbed. Electricity produced in this simple way—by the rubbing together of certain substances—is termed **frictional** or **static electricity** or **franklinism.**

When two dissimilar metals like copper and zinc are placed in a corrosive fluid and united outside by a loop of wire, the resulting chemical action is attended with the production of an electric current, and to this manifestation of electricity the term **galvanism** is applied. The vessel, its contained fluid, and connected elements together constitute a *galvanic cell.* The union of several cells forms a *battery.* The energy which starts the electric current is termed the *electromotive force*, and it is always the same in quantity for the same materials at the same temperature, and is entirely independent of the size and shape of the plates and of the distance between them. The current is generated at the surface of the element or plate more easily corroded, which in the above illustration is the zinc, and passes through the fluid to the element or plate less affected,—that is, the copper,—and from the external end of the copper it passes through the wire loop back again to the external end of the zinc, thus completing a *closed circuit.* As the external end of the copper is constantly giving off electricity, it is termed the *positive pole*, or *anode;* and as the external end of the zinc is constantly receiving electricity, it is termed the *negative pole*, or *cathode.*

It is evident that the electromotive force will more than represent the strength of the current, for all substances offer more or less resistance to the passage of electricity. The resistance within the cell is termed the *internal resistance*, and that without the cell the *external resistance.* The amount of internal resistance will depend upon the character of the inter-

vening fluid, the size of the plates, and their proximity. T
larger the plates and the closer they are to each other, the l
becomes the internal resistance. The external resista
depends upon the length, diameter, and character of the c
ductor. The law of the relation of the *current-strength* to
electromotive force and to the resistance was discovered
Ohm, in 1827: *The strength of an electric current passin
section of the conductor in a unit of time is proportional to
whole electromotive force, and inversely proportional to the
of all the resistances in the circuit.* Representing the curr
strength by *C*, the electromotive force by *E*, the inte
resistance by *Ir*, and the external resistance by *Er*, the
may be expressed by the following formula:

$$C = \frac{E}{Er + Ir}.$$

The unit of resistance is termed an *ohm;* the unit of ele
motive force, a *volt;* and the unit of current-strength
*ampère.* As the last is too large a unit for medical purp
$\frac{1}{1000}$ of an ampère, or a *milliampère,* is employed instead.
An electromotive force of one unit acting upon a condu
offering one ohm of resistance will set up in that conduc
current of one ampère.

The current-strength of a battery can be increased in
ways: (1) By diminishing the external resistance; (2
diminishing the internal resistance; and (3) by increasing
number of cells. When the external resistance is a
quantity, which is often the case, the current-strength ca
be increased in one of the two remaining ways; but whe
external resistance is very great, as in the case of the h
body, in which it is about 3000 ohms, the gain secure
enlarging the plates and lessening the distance between
is but trifling, and the current-strength must, therefor
increased by multiplying the number of cells.

When the external resistance is slight, as in the gal
cautery, in which the current has only to render a pie
wire incandescent, the internal resistance becomes h
important, and much is gained by reducing it to a mini
It follows, therefore, that a battery designed for such a
pose should consist of a few cells with large plates place
near one another. The same principles likewise apply
construction of batteries intended for electrolytic work.

Of the accessories to a battery, the most important a
galvanometer, rheostat, and electrodes.

A galvanometer is an instrument for measuring the current-strength.

A rheostat, or resistance-coil, is an appliance for placing in the circuit a known resistance; by it the external resistance can be increased to any extent and kept uniform.

Electrodes are appliances of various sizes and shapes placed at the pole-ends so that the current can be conveniently transferred to the body.

**Faradism, or Induced Electricity.**—This manifestation of electric force depends upon the power which a galvanic current possesses, while passing through one conductor, of inducing momentarily a current in an overlying conductor. The induced current is instantaneous, and appears only at the making or breaking of the galvanic current. Moreover, it flows in a direction opposite to that of the galvanic current when the latter is made, and in the same direction when it is broken. By rapidly making and breaking the primary current a powerful to-and-fro current is induced in the overlying conductor. A faradic battery consists of cells for generating the galvanic current; a *primary coil*, consisting of a few turns of coarse insulated wire inclosing a coil of soft iron; a *secondary coil*, composed of many turns of very fine wire surrounding the primary coil, but not touching it; and a mechanical device for slowly or rapidly making or breaking the current in the primary circuit.

The current derived from the primary coil is termed the *primary current;* like the galvanic, it flows in one direction and affords a positive and a negative pole. It differs, however, from the galvanic current in being reinforced by the turns of the coil. The current derived from the secondary coil is termed the *secondary current*, and, since it is ever changing the direction of its flow, it cannot furnish negative and positive poles.

**Physiologic Action of Electricity.**—When a powerful uninterrupted galvanic current is applied to sensitive parts of the body through moistened electrodes, it produces at the points of contact severe burning pain, redness, and, finally, under the negative pole, vesication. These phenomena are the result of electrolytic changes induced by the current. When the circuit is broken and again when it is closed active muscular contraction occurs; in the interval between opening and closure, however, the muscle is quiescent.

When the negative pole, or cathode, is placed over the nerve supplying a muscle, and the positive pole, or anode, over some indifferent point, as the sternum, and a weak current is

used, a contraction of the muscle occurs on closing the circuit, but none on breaking it. When the positive pole is placed over the nerve and the negative over the sternum, and a somewhat stronger current is employed, a contraction occurs when the circuit is broken. With a still stronger current a contraction occurs also when the circuit is closed. When the positive pole is over the nerve, contractions on breaking the circuit occur only with currents of very great power.

The following table represents the relative strengths of the various contractions in normal muscles, 1 being the strongest:

1. Cathodal closing contraction (CaClC).
2. Anodal opening contraction (AnOC).
3. Anodal closing contraction (AnClC).
4. Cathodal opening contraction (CaOC).

When one pole is placed over the sternum and the other over the *motor point* of the muscle,—*i. e.*, the point of entrance of its motor nerve,—contractions are obtained with weaker currents and the reactions are somewhat changed, the anodal closing contraction becoming stronger than the anodal opening contraction.

**Effect of the Faradic Current.**—When a strong induced current is applied to a part it causes a tingling sensation, followed by numbness. If a dry metallic electrode be used, the contact excites severe pain. When the current is passed directly through a muscle, it causes a continuous or tetanic contraction which lasts until the current ceases to flow.

**The Reaction of Paralyzed Muscles to Electric Currents.**—When a galvanic current is applied to a paralyzed part, the reactions may be normal, they may be altered quantitatively, *i. e.*, increased or diminished,—or they may be altered qualitatively.

A normal response of the muscles to both galvanic and faradic currents often occurs in hysteric paralysis and in paralysis of cerebral origin. An increased response to both currents without qualitative change indicates a state of irritation or hypersensitiveness of the spinal centers or peripheral nerves, and may be observed very early in apoplectic hemiplegia, very early in neuritis, and in some cases of hysteria. A diminished response to both currents without qualitative change is observed in pseudomuscular hypertrophy, in progressive muscular atrophy until a late period of disease, and sometimes in neuritis after the very early stage, and before much degenerative change has taken place in the nerve-trunk or muscles.

**Reaction of Degeneration** (DeR).—This consists in a qualitative change in the electric reaction, a reversal of that occurring in normal muscle. It is obtained only with the *galvanic current* when the electrode is placed over the *muscle*,—not its motor nerve or motor point,—and is observed in paralyzed muscles which are in certain stages of degeneration on account of a lesion of their supplying nerves or of that portion of the spinal cord from which those nerves have their origin; or, in other words, when the muscles are cut off from the trophic influences which emanate from the ganglionic cells in the gray matter of the spinal cord. In such cases the muscles fail to respond to the faradic current, but still respond to the galvanic current. The responses, however, instead of being immediate and short as in health, are sluggish and persistent, and, moreover, are reversed in their sequence. Thus, the anodal closing contraction may equal, or at a later period may exceed, the cathodal closing contraction, and the cathodal opening contraction may equal or exceed the anodal opening contraction. These reactions may be expressed as follows:

AnClC equals or is greater than CaClC.
CaOC equals or is greater than AnOC.

**Administration.**—The galvanic current may be applied in various ways. In the *stabile* or *continuous method* the electrodes are applied firmly over the desired points and are kept stationary while the current is flowing. In the *labile* method an electrode is placed over an indifferent point, while the other is slowly stroked over the affected part, but not lifted from the skin. In this way contraction of all parts of a muscle may be secured. In the *interrupted* method one electrode is kept stationary while the other is alternately applied and removed, or both electrodes are kept stationary while the current is interrupted by means of a mechanical device in the handle of one of the electrodes. Finally, the electrodes may be kept stationary while the current is repeatedly *reversed* by making pole-changes in the metallic circuit. By interrupting and reversing the current very decided stimulant effects may be secured. In all applications of the galvanic current the electrodes should be well moistened with warm water.

In applying the faradic current to muscles, one large electrode should be placed over an indifferent point and the other over the body of the muscle to be treated, or, if a more decided action is desired, over the motor point of the muscle. Both electrodes should be well moistened. If the peripheral

ends of the cutaneous nerves are to be treated, the skin should be thoroughly dried and the current applied through a wire brush, the indifferent electrode only being moistened. As the dry skin has a very high resistance, it is necessary in applying the wire brush to employ a secondary coil with many turns (2000 or 3000) of fine wire.

General faradization may be practised by passing one electrode slowly over the surface of the body, the other being held stationary; or it may be practised by means of the *electric bath.* In the latter the patient's body is immersed in warm water through which a current is made to pass.

In franklinization the current is applied to the body in the form of sparks or a spray drawn from an electric machine of high potential. Such a machine should have from eight to twelve revolving plates of a diameter of not less than 20 inches.

The dosage of electricity can be estimated only very roughly. Two important factors are the current-strength and the size of the electrodes. In galvanic applications the current-strength can be accurately determined by means of the absolute galvanometer. The concentration or density of the current, however, must also be considered, and this depends largely upon the size of the electrodes. Thus, the larger the electrode,—owing to a greater opportunity for diffusion,—the less powerful the local effect. The current-density equals the current-strength divided by the surface of the electrode. We may express the dosage approximately, therefore, by a fraction, the numerator of which is the current-strength in milliampères and the denominator of which is the surface of the electrode in square centimeters. The fraction $\frac{1}{20}$, for instance, would indicate a current-strength of 1 milliampère and an exciting electrode of 20 square centimeters.

The only practical way of measuring the strength of the faradic current is by means of an arbitrary scale indicating the relative positions of the primary and secondary coils. As the thickness and length of the wire used in the coils influence decidedly the magnitude of the current, it follows that the readings of such a scale are of little value in comparing the results obtained with different instruments. Such general terms as weak, medium, and strong are usually employed to express the strength of faradic currents. As regards static electricity, there is no method of measuring the strength of the current that has even a semblance of accuracy.

Until we possess more accurate means of computing the dose of the several currents we must, perforce, be guided in

their use very largely by the sensations of the patient and the activity of the muscle reactions.

The selection of the proper current cannot always be made offhand; in very many cases it must be determined empirically.

The duration of the applications in localized electrification should generally be from three to five minutes, and the treatment should be repeated two or three times a week, or even daily in acute cases. In general electrification each séance may last from ten to twenty minutes, and be repeated two or three times a week. Pain and fatigue are to be avoided.

**Therapeutics.**—Electricity is employed in medicine to restore functional activity to peripheral nerves and muscles when conduction has not been completely cut off by some irreparable lesion; to promote general nutrition; to arouse the nerve-centers in states of depression; to combat various sensory disturbances which are of a functional character or which depend upon minor lesions of the peripheral nerves or their centers; to effect the rapid passage of drugs through the unbroken skin (cataphoresis); to bring about the coagulation of blood in aneurysmal sacs; to favor the absorption of inflammatory or degenerative products; and in the form of the galvanocautery, to excise or destroy hypertrophied tissues or morbid growths.

Whether the good achieved by electricity, especially by franklinism, in functional nervous diseases is to be attributed to the specific action of the electricity itself, or whether it is to be regarded as being wholly the work of suggestion, is a question upon which opinion is divided. It cannot be denied, however, that in some of these cases, at least, the benefit derived is the result rather of psychologic than of physiologic effects.

In a large group of cases the efficacy of electricity depends upon its power to excite muscular contraction. In *apoplectic hemiplegia* triweekly applications of a faradic current sufficiently strong to produce good contractions of the affected muscles are often very useful. The treatment should not, however, be begun until three or four weeks after the attack, and need not last more than five or six weeks. Contractures are very rarely benefited, although occasionally slight relief is afforded by faradization of the muscles antagonistic to those which are affected.

In *paralysis from lesions of the peripheral nerves*, such as neuritis, if the damage to the nerve has not been too great, much may be hoped for from the use of electricity. It should never be employed, however, until all symptoms of irritation have subsided. The faradic current is to be used if the mus-

cles respond to it. In the more severe cases in which faradic excitability is lost, labile and interrupted galvanic currents should be applied with the pole which produces the best contractions. In very severe cases with well-marked reaction of degeneration nothing is to be expected from electric treatment. In some cases of multiple neuritis the electric bath may be used with advantage.

In *infantile spinal paralysis* electric treatment persistently carried out for several months is not infrequently followed by a restoration of power in certain groups of muscles. The applications should be begun about three weeks after the onset of the disease, and made three or four times weekly. When faradic contractility is lost, as is usually the case, galvanism should be employed, one electrode (cathode) being placed over an indifferent point, such as the spine, while the other (anode) is slowly stroked over the affected muscles. In spinal spastic paralysis and the progressive muscular dystrophies nothing can be hoped for from electricity.

In *locomotor ataxia*, while electricity exerts no influence on the progress of the disease, it is sometimes very useful in the form of the faradic brush in relieving lancinating pains and paresthesia. J. K. Mitchell has found faradism especially beneficial also in rectal and vesical tenesmus, given with one pole in the rectum and in the latter altogether percutaneously.

In the so-called idiopathic forms of *neuralgia* electricity may afford great relief. The stabile galvanic anode should be used first, and, failing with this, faradism should be tried, the current being taken from a secondary coil wound with fine wire 5000 or 6000 feet in length. Static electricity has also been used in some cases with good results. Temporary alleviation of pain can be secured by cataphoresis. A satisfactory method is to cover the positive pole with several layers of tissue-paper wet with a 10 per cent. solution of cocain, and to apply it over the most painful spot. With a current of from 5 to 10 milliampères local anesthesia can be produced in about five minutes.

In *neurasthenia* general electrization (faradism or galvanism) is often a useful adjuvant to other therapeutic measures. It must be employed, however, with considerable circumspection, since in some cases the symptoms appear to be rather aggravated than relieved by the treatment. Only mild currents should be used, and at first the applications should not last longer than five or ten minutes.

In *hysteria* electricity is sometimes remarkably efficacious, probably through its psychic effect, in dispelling certain local

symptoms, such as anesthesia, analgesia, pain, paralysis, and contractures. Faradization with the wire brush and franklinization, to which hysteric subjects are often very tolerant, are the currents most generally useful. General faradization, also, forms a part of the Weir-Mitchell treatment, which is especially applicable to obstinate cases.

In *exophthalmic goiter* galvanic treatment systematically carried out is sometimes followed by distinct improvement, especially in the tachycardia. The best results are obtained with weak currents, the cathode being placed over the neck near the angle of the lower jaw, while the anode is applied to the opposite side next to the lower cervical vertebræ. The applications should be made daily, and each should be short, lasting not longer than from three to five minutes.

In *chronic myalgia*—lumbago, torticollis, and pleurodynia—faradism applied by means of the wire brush and electrostatic treatment are sometimes of benefit.

In *poisoning by opium and other narcotics* a strong faradic current affords an excellent means of arousing the patient without increasing the exhaustion or causing any ill effects.

The method of treating *aneurysms of the aorta* by means of a fine wire introduced through a hollow needle and coiled within the sac was first suggested by Charles H. Moore, in 1864. Corradi, in 1879, demonstrated that the procedure could be made more effective by passing a strong galvanic current through the wire, thus producing more rapid and firm coagulation. In this country the experiments of D. D. Stewart[1] and of Guy L. Hunner[2] have done much to bring the operation into prominence. Hunner, in 1900, collected 23 cases (17 thoracic and 6 abdominal) treated by the Moore-Corradi method. Four of these (17 per cent.), 3 thoracic and 1 abdominal, were apparently cured; 9 (39 per cent.) were distinctly improved; and in 10 death was probably hastened by the treatment. The technic, according to Stewart, is briefly as follows: Asepsis, insertion into the aneurysm, where the sac-wall seems nearest to the surface, of an insulated hollow needle, through which is introduced silver wire (about No. 27). It must be well drawn, wound on a spool, and from 3 to 20 feet in length, according to the size of the cavity. The wire is then attached to the positive pole of a galvanic battery, the negative electrode, large and well moistened, being applied to the back, and a current of from 70 to 80 milliampères passed for from half an hour to an hour and a half. The wire

[1] *Phila. Med. Jour.*, November 12, 1898.
[2] *Johns Hopkins Hosp. Bull.*, November, 1900.

is then cut close to the skin and sunk beneath the surface. In cases of thoracic aneurysms the anesthesia may be local. The chief dangers, according to Hunner, are from sepsis, rupture of the aneurysm from increase of pressure due to coagulation in a portion of the sac only, the entering of a loop of wire into the aorta, and emboli breaking from the sac-wall. Failure is to be expected in aneurysms with fusiform sacs and when there is marked general arteriosclerosis. In view of the gravity of the disease and the inefficiency of medical treatment the results so far obtained from this method of treatment must be considered encouraging.

Galvanism has been employed for its electrolytic effects in *uterine fibroma*, *goitre*, *tonsillar hypertrophy*, etc., but the results achieved have not been sufficiently satisfactory to establish this method of treatment in the confidence of the profession.

## MASSAGE.

The term massage is applied to systematic stroking, kneading, rubbing, and percussion of the body. One who practises massage is known as a *masseur*, if a male, and as a *masseuse*, if a female.

*Effleurage*, or stroking, consists in slowly drawing the flat of the hand or the finger-tips over the surface of the body in the direction of the venous circulation. Very slight pressure should be made in the movements. Effleurage stimulates the cutaneous nerves and quickens the lymphatic and venous circulations.

*Pétrissage*, or kneading, is performed by grasping the tissues between the palmar surfaces of the hands, between the fingers and thumb, or between the finger-tips only, raising them slightly, and then rolling them while alternately tightening and relaxing the hold. Kneading serves to remove waste-products from the tissues, stimulates the circulation, and promotes nutrition.

*Friction*, or rubbing, is done by making circular movements, under some pressure, with the palm of the hand or the finger-tips, the up-stroke being heavy and the down-stroke light. The movements should always be centripetal. Friction exerts about the same influence on the tissues as kneading.

*Tapotement*, or percussion, consists in delivering, with the palm of the hand, the ulnar surface of the hand, or the tips of the fingers, rapid rhythmic blows. Palmar percussion is used chiefly on the limbs; ulnar percussion on the chest and back;

and digital percussion on small uneven surfaces like the face. Percussion acts as a nerve and muscle stimulant.

**General Massage.**—When general massage is to be practised, the operator begins at one extremity, generally a leg, and applies to each in turn friction, kneading, palmar percussion, and palmar stroking. After the limbs, the chest receives friction, kneading, ulnar percussion, and palmar stroking. Next the abdomen is treated, deep friction and kneading being applied over the entire surface, and palmar stroking along the course of the ascending, transverse, and descending colon. Finally, vigorous stroking is applied over the spine from above downward, and the muscles of the back are subjected to friction, kneading, and ulnar percussion. In some cases various movements, such as flexion, extension, circumduction, etc., intended to secure passive exercise of the muscles, are a valuable adjuvant to general massage.

Generally, massage is best given in the forenoon, about an hour after breakfast. It should never be given on an empty stomach. At first the séances should not last more than fifteen or twenty minutes, but later they may be extended with advantage to an hour. To secure the best results the operation should be repeated daily. The patient should be recumbent and loosely wrapped, so that the hands of the operator may be applied directly to the skin. The room should be free from drafts, and the temperature of the atmosphere about 70° F. (21.1° C.). After the treatment the patient should be warmly covered and left to rest for from twenty minutes to an hour.

Unless the patient's skin is very harsh and dry or is unduly sensitive, the masseur need not use a lubricant for the hands; if, however, one is desired, cocoanut oil or cold cream is probably the best.

The effects of general massage in individuals who are required to be at rest are much the same as those of active exercise in persons who are able to be about. Thus, the immediate effects are a sense of tiredness without exhaustion and an agreeable feeling of drowsiness. The general circulation is first quickened and then slowed, the waste-products are squeezed out of the tissues, and the activity of the lymph-flow is increased. Later, massage whets the appetite, favors digestion, tends to secure restful sleep, stimulates metabolic activity, and promotes general nutrition.

**Therapeutics.**—In the *paralysis* following cerebral hemorrhage, acute poliomyelitis, and neuritis massage is of great value in maintaining the nutrition of the affected muscles; even when power is hopelessly lost, it tends to retard the

development of contractures. Mechanical treatment, however, should not be instituted in these cases until all signs of irritation have subsided. In *neuralgia* and *sciatica* local massage is a useful adjuvant to other measures.

*Writers' cramp* and other *occupation spasms* are best treated by rest, massage, and galvanism.

In *sprains* rapid relief is afforded by soaking the part in hot water for half an hour, then practising massage, and subsequently applying a firm bandage. The treatment should be instituted immediately after the accident. For the first ten or fifteen minutes the massage should consist of light digital stroking applied in a centripetal direction above and below the affected joint, the latter not being touched; after this, however, gentle friction may be applied directly to the inflamed tissues. The treatment should be repeated two or three times daily.

Massage is often serviceable in hastening the absorption of inflammatory exudation and in imparting suppleness to the affected joints, in *traumatic arthritis, luxations, synovitis, chronic articular rheumatism, chronic gout,* and *rheumatoid arthritis.* In acute rheumatism and acute gout manipulations are contraindicated while the acute symptoms are present.

In *chronic constipation* the result of intestinal atony, abdominal massage systematically practised is a most effective remedy.

In *hysteria* and *neurasthenia* passive movements afford a valuable means of securing the benefits of exercise without the expenditure of strength. They are an important element in the Weir-Mitchell treatment, which includes also isolation, the administration of readily assimilable food in large quantities, and electricity. In *chronic heart-disease, diabetes, obesity,* and *severe anemia,* when the patient is unable to take active exercise, massage is a great help in stimulating metabolic processes and in improving the general nutrition.

**Contraindications.**—Massage should not be employed in any disease that is attended with fever. In pregnancy abdominal manipulation is contraindicated, although the treatment may be applied to other parts of the body up to the first stage of labor. Inflammatory diseases of the skin and processes attended with suppuration also forbid massage.

## MOVEMENT THERAPY FOR LOCOMOTOR ATAXIA.

The treatment of locomotor ataxia by exercises intended to reëducate the muscles to perform coördinated movements, first described by Frenkel in 1890, has won for itself the sup-

port of many distinguished neurologists. Properly carried out, it may serve to keep patients on their feet for several years, when otherwise they might become bedridden, or it may serve even in getting them about again when they have been unable to walk for a long period, perhaps many months.

For exercising the upper extremities the following directions are given: Sit in front of a table, place the hand upon it, then elevate each finger as far as possible; raising the hand slightly, extend and then flex each finger and thumb as far as possible; do this with the right and then with the left hand. Touch with the end of the thumb each finger-tip separately and accurately; then touch the middle of each phalanx with the tip of the thumb. Sit at the table with a large sheet of paper and a pencil; make a dot at each corner of the paper and one in the center, and draw lines from the corner dots to the center dot, first with one hand and then with the other. Put ten coins on the paper, pick them up, and place them in a single pile, first with the right and then with the left hand.

For the body and legs, the following are sample exercises: Sit in a chair, rise slowly to erect position without the help of cane or arms of chair; then sit down slowly; stand with cane, feet together; advance left foot and return it with exactness to original position; then the same with right foot. Walk slowly ten steps forward and five back with help of canes. Stand without cane, but with the feet a little apart and the hands on the hips; in this position stoop down by flexing the knees, and rise slowly. Stand without cane with the feet separated; raise the hands from the sides above the head; carry them downward and forward, and try to touch the toes. Walk along a fixed line on the floor by the help of a cane, placing each foot in turn on the line; then repeat without using the cane.

When the patient is confined to bed, the exercises must be taken in a recumbent position. He is required to flex, extend, abduct, and adduct each leg separately and then both simultaneously. He is asked to place the heel of one foot on the big toe of the other foot, and then on various points from the ankle to the knee. He may be called upon to follow alternately, first with one foot and then with the other, lines drawn upon a small blackboard placed at the foot of the bed (Rhein).

To secure good results from Frenkel's treatment, the following points should be borne in mind: The exercises must not be applied in a routine manner; they should be carefully adapted to the particular needs of each patient. Each movement should be made slowly and deliberately, with the greatest possible exactitude, and repeated three or four times, first with

the eyes open and then with the eyes closed. Owing to benumbing of the sense of fatigue in tabetic patients, great must be exercised to guard against exhaustion. The séa should not last longer than ten or fifteen minutes, and at no more than two should be allowed a day. After the e cises the patient should lie upon his back until comple rested. Gymnastics of all kinds are to be forbidden during treatment. For the first week or two, at least, the movem should be done under the direct supervision of the physi himself or a trained assistant. The duration of the treatn will depend largely upon the degree of the motor disturba present, but in any case it should not be less than sev months. Even when the exercises appear to be no lo necessary, they should be resumed at frequent intervals.

**Contraindications.**—According to Frenkel, the treatn is absolutely contraindicated in acute cases. As visio essential in performing the various movements, blindnes also a contraindication. Raichline further adds that the pa should possess a certain amount of energy and intellige that sensation should not be absolutely lost, and that arth athies and spontaneous fractures should not be present.

## THE SCHOTT OR NAUHEIM TREATMENT

The treatment of chronic heart-disease carried out by brothers Schott at Nauheim, Germany, consists of bathin natural effervescent baths and of graduated exercises. waters of Nauheim have a temperature of from 86° to 95 (30°–35° C.), and are very rich in carbonic acid and in n eral ingredients, especially sodium chlorid and calcium chl The baths first prescribed have a temperature of from to 90° F. (35°–32° C.), contain about 1 per cent. of sod chlorid and 0.1 per cent. of calcium chlorid, and are free f carbonic acid gas. The patient is directed to remain in water not more than five or ten minutes. The duration of baths and their salinity are gradually increased, while t temperature is gradually lowered. Eventually, after the la of a week or two, baths containing carbonic acid gas, about 3 per cent. of sodium chlorid and 0.3 per cent. of cium chlorid are taken, the temperature of the water be reduced as low as 80° F. (28° C.). After the bath the pati is well rubbed and allowed to rest for an hour.

Artificial baths may be prepared at home in imitation those at Nauheim. At the beginning of the treatment bath should contain 1 pound (454.0 gm.) of sodium chlo

and 1½ ounces (45.0 gm.) of calcium chlorid for every 10 gallons (38.0 L.) of water, and the temperature of the water should be from 95° to 90° F. (35°–32° C.).

The baths may be given every other day or every day, their duration being gradually prolonged from five or ten minutes to fifteen or twenty minutes. With the increased duration of the baths their temperature is gradually lowered until a minimum of 80° F. (28° C.) is attained, and their salinity is gradually increased until a maximum of 3 pounds (1360.0 gm.) of sodium chlorid and 4½ ounces (140.0 gm.) of calcium chlorid to every 10 gallons (38.0 L.) is reached.

The plain saline baths are to be followed by effervescent baths. The latter may be prepared artificially by dissolving in the saline baths 2 ounces (60.0 gm.) of sodium bicarbonate for every 10 gallons (38.0 L.) of water, and then adding very slowly 3 ounces (90.0 c.c.) of hydrochloric acid which has been previously well diluted. The amount of soda and acid may be gradually increased until that of the former reaches a maximum of 8 ounces (245.0 gm.), and that of the latter a maximum of 12 ounces (355.0 c.c.).

A more convenient method of generating the carbonic acid is by using prepared tablets of sodium bisulphate with an acid reaction and powders of sodium bicarbonate.

The effect of the baths is to diminish the pulse-rate, to increase the force and volume of the pulse, to lessen the frequency of the respirations, to increase the secretion of urine, and, in cases of cardiac dilatation, to diminish the area of cardiac dulness. The theory of August Schott is that the good effects of the baths are largely the result of a reflex stimulation of the heart through excitation of the cutaneous nerves.

The exercises consist of a series of simple movements of each limb and of the trunk, which are gently resisted by the hand of the attendant. Massage may also be added to the gymnastics with good results. It is highly important in carrying out the exercises to avoid fatigue. The slightest suggestion of dyspnea or of cyanosis is to be regarded as a signal for discontinuing the treatment. The effects of the exercises are very similar to those produced by the baths. It has been suggested that these effects are also brought about reflexly, a centripetal influence being exerted by the muscular contractions upon the ganglionic centers of the heart.

Broadbent, however, is of the opinion that "the baths or resisted movements give rise to a physiologic dilatation of the cutaneous capillaries or muscles respectively, so that the resistance to the onward movement of blood is lessened, and the left

ventricle, thus relieved, is able to complete its systole. At same time, from the moderate and gentle character of exercises, compression of the veins, such as occurs in sev muscular exertion, driving on the blood to the right ventr and causing dyspnea, does not take place. There is thu transfer of blood from the venous to the arterial system, wh is the reverse of the tendency in most forms of heart disea

Without doubt, the Schott treatment, especially when carried out at Nauheim, is frequently followed by bril results. It is not applicable, however, to every case of h disease; neither is it entitled to supplant the older and proved methods of treatment. At most, it should be rega as no more than a valuable auxiliary to rest, diet, and dr It must be admitted, too, that home treatment with arti baths and resistance exercises, while not wholly wantin efficacy, is much less beneficial than a course of treatme Nauheim. Change of air and scene, the regulation of mode of life of the patient, rest, and quiet unquestionably tribute largely to the success which has been achieved at celebrated German spa.

The treatment is chiefly applicable to cases of *cardiac di tion in which there is but slight degeneration of the myocard* The contraindications are advanced degeneration of the cardium, pronounced arteriosclerosis, and aneurysm.

## COLD.

Cold applications may be local or general. Locally, may be applied by means of cloths wrung out of iced w an ice-bag, an ice-poultice, or Leiter's tubes. Heat may be abstracted by spraying the part with a highly volatile li like ether or ethyl chlorid. An ice-bag may be made ch and conveniently by filling a pig's bladder with cracke closing it securely, and covering it with flannel. An ice- tice may be made by sewing up tightly in rubber cloth coarse towel crushed ice mixed with salt and sawdust, or ground flaxseed. Leiter's tubes are flexible metal arranged in the form of coils to fit the head, chest, abdo and other parts of the body. Two long rubber tubes are nected with the coil, one to carry ice-water from a rese placed a few feet above the patient's head, the other to co the water after its passage through the coil to a pail place the floor near the bed. Leiter's tubes are especially u when the cold is to be applied continuously.

Local applications of cold abstract heat from the part, l

the sensibility of the peripheral nerve-filaments, cause constriction of the blood-vessels traversing the tissues exposed to the cold, and even affect reflexly, as Winternitz has shown, the vascularity of parts remote from the seat of the application.

Cold may be applied to the whole or to a considerable portion of the body in several ways: by cold sponging, the cold pack, the cold douche, or the cold bath.

Cold sponging consists in freely sponging the body with water at a temperature of from 80° to 70° F. (27.5°–21° C.), care being taken not to expose more than one part at a time. The sponging may be made more effective by adding a little alcohol or vinegar to the water.

In applying the cold pack, the bedding is first protected by water-proof sheeting; the patient is then stripped and enveloped in an ordinary sheet wrung out of water at a temperature of 70°–60° F. (21°–15.5° C.). The sheet should be well tucked in at the neck and feet, and closely adapted to all parts of the body. The pack is usually continued for from ten to fifteen minutes, and during this time it is necessary to sprinkle the sheet at frequent intervals with water sufficiently cool to maintain a uniform temperature.

The cold douche may be given by placing the patient, wrapped in a sheet, in a bath-tub, and then pouring cold water on him from a pail or watering-pot, or the water may be conducted through a rubber tube attached to a faucet and directed to various parts of the body.

In the cold bath the temperature of the water may range from 90° to 60° F. (32°–15.5° C.), and the immersion may last from a minute or two to twenty or even thirty minutes, according to effect desired.

When cold is applied suddenly to a considerable portion of the body of a man in good health, the immediate effects are contraction of the cutaneous vessels, pallor of the surface, erection of the papillæ of the skin (cutis anserina), momentary catching of the breath, and a feeling of coldness, with shivering. On coming out of the bath vigorous subjects, especially if the skin be well rubbed, quickly experience a reaction. The cutaneous vessels dilate, the skin becomes flushed, and the patient feels warm and exhilarated. In delicate subjects, especially if the immersion be somewhat prolonged, this reaction may be very imperfect or altogether wanting, in which case the patient may remain chilly and depressed for several hours after the bath. When followed by a good reaction, cold bathing exerts a powerful tonic effect. It sharpens the appetite, aids digestion, promotes tissue-change, and favors the elimina-

tion of waste-products. In pyrexia, general applications cold lower the temperature, increase the flow of urine, strength and slow the pulse, and invigorate the nervous system.

**Therapeutics.**—In the early stage of *acute inflammati* especially that resulting from traumatism, a cold-water dre ing often acts most happily. In *diphtheria*, *scarlet fever*, a *acute tonsillitis* the application of cold compresses or of ice-bag to the throat generally affords more relief than po tices or fomentations. In *chilblain* or *frost-bite* the intensity the reaction should be moderated by rubbing the part v snow or ice. In *croupous pneumonia*, when the temperatur high and the pulse strong, an ice-bag or an ice-poultice justed over the affected lung reduces the fever, allays the p and quiets the patient. In *acute dysentery* Wood has fo ice-suppositories inserted for a length of time, one after anot very useful in allaying tenesmus. An ice-cap or an ice- may be applied to the head with advantage in *meningitis*, *plexy*, *cerebral congestion*, *headache*, and the *delirium of fe* In *neuralgia* dry cold sometimes affords temporary relief, as a rule, heat is more grateful. In *exophthalmic goiter*, *pa ysmal tachycardia*, and *symptomatic palpitation* an ice-bag Leiter's coil over the precordia often exerts a sedative influ upon the heart. An ice-bag may also temporarily relieve tress in *aortic aneurysm*, especially when the sac is superf Prior to the performance of acupuncture or of paracentes to using the actual cautery, *local anesthesia* may be secure spraying the part with ethyl chlorid or ether, or holding it for a few minutes a block of ice which has been sprin with common salt. In *internal hemorrhage* the applicatio an ice-bag over the affected region is a useful adjuvant to measures.

General applications of cold are used for their antipy and tonic effects. In *typhoid fever* and other *continued f* hydrotherapy has given excellent results. There is a evidence to show that the mortality of typhoid fever in ge hospitals has been reduced at least one-half under the ment by cold bathing, so ably advocated by Brand, of S The details of this treatment are as follows: A bath-tub full of water at 70° F. (21° C.) is kept in readiness nea bed, and every third hour, if his temperature is above 102 (39° C.), the patient is wrapped in a sheet and carefully into the water. While in the bath an ice-cap is kept upo head or cold affusions are applied to it, and the trunl limbs are vigorously rubbed, so as to bring new relays of to the surface. A stimulant is sometimes given befo

bath to lessen the shock. At the end of fifteen or twenty minutes the patient is carried back to bed and covered with a dry sheet and a light blanket. After he has been thoroughly dried, the damp coverings are removed and replaced by dry ones. If the patient be delicate, it is preferable to place him in a bath of 90° F. (32° C.), and then gradually lower the temperature of the water to 70° F. (21° C.). The good effects of the bath are: reduction of temperature, increased secretion of urine, marked improvement in the pulse, and lessening of the nervous symptoms—delirium, stupor, insomnia, and subsultus tendinum. The only contraindications are perforation, hemorrhage, and persistent prostration after the bath. Shivering and blueness naturally follow the bath, and, unless very prolonged, are not to be considered contraindications.

When the baths are not well borne, or the temperature shows no tendency to exceed 102.2° F. (39° C.), cold sponging or the cold pack may be substituted for immersion.

The *hyperpyrexia of thermic fever* or of *acute rheumatism* should be treated by immersing the patient in water containing crushed ice, or, better, by rubbing him with blocks of ice for ten or fifteen minutes.

In *neurasthenia* and *hysteria* hydrotherapy in the form of the cold spray, cold douche, or cold bath, is often a valuable auxiliary to rest, massage, and isolation. It is very important, however, not to institute the treatment too abruptly, as otherwise it may prove harmful rather than beneficial. In *chorea of childhood* the wet-pack (80°–70° F.—26.5°–21.0° C.) is sometimes very beneficial.

## HEAT.

Heat may be applied in the dry or moist form, and the application may be local or general. Locally, dry heat is applied by means of hot cloths, bran-bags, water-bags or water-bottles, or local baths of superheated dry air. Moist heat may be applied by means of fomentations, poultices, or the douche. Hot-water baths are also applicable to certain limited portions of the surface of the body. Heat, locally applied, allays irritation of the peripheral sensory nerves, dilates the cutaneous vessels, increases the secretion of sweat, and probably, like cold and counterirritation, exerts reflexly some influence on the nutrition of the superficial tissues, and even of the underlying organs. Intense dry heat (300° F.—149° C.) not only affects the tissues to which it is directly applied, but also produces general diaphoresis, raises the body-

temperature two or three degrees, and increases the frequen of the pulse.

Dry heat may be applied to a considerable portion of t surface of the body by means of the hot-air bath. This is b given with the patient in bed, a spirit-lamp being used to g erate the heat, which is conducted under the bed-clothes the aid of an inverted funnel and L-shaped tube. The pati is stripped and wrapped snugly in a blanket, and the b clothes, over which have been spread a rubber sheet and extra blanket, are slightly raised by means of a cradle, so t the hot air can freely enter and surround the body. The b may last from fifteen to thirty minutes. The effect of a g eral application of dry heat may also be obtained in the Turk bath. In this the patient is conducted through a series heated apartments, the first having a temperature of 100° (38° C.) and the last 150° F. (66° C.) or above. After per ration has been freely established, he is thoroughly sh pooed and rubbed, and then given a cold douche or a plun bath.

The general application of moist heat may be obtained means of the hot-water bath, hot-pack, or hot vapor-bath. the hot-water bath the temperature of the water should b first about 98° F. (37° C.), but this should be raised gradu while the patient is still in the bath to 105° F. (40.5° C.) even to 110° F. (44° C.). The bath may last, according circumstances, from fifteen minutes to half an hour or lon In the warm bath the temperature may range between 98° 85° F. (37°–30° C.).

The hot-pack is given by closely enveloping the patien a blanket wrung out of hot water, covering him with two more blankets and a rubber sheet, and then placing hot bot at each side and at his feet. The pack may last from half hour to an hour. A hot vapor-bath may be given in the s way as a hot-air bath, steam from a boiling kettle being c ducted under the bed-clothes instead of hot dry air, or steam may be generated under the bed-clothes by plac about the patient hot bricks or plates which have been wrap in wet cloths. In the Russian bath, also, steam replaces hot dry air of the Turkish bath.

The first effects of the general application of heat are dil tion of the cutaneous vessels and the establishment of perspiration. The administration of cool drinks during exposure makes the application more effective by driving blood from the interior to the surface of the body. There ordinarily, no marked rise in the central temperature of

body, since the accumulation of heat is prevented by the free sweating. If, for any reason, diaphoresis does not occur, however, the central temperature may rise somewhat—even to a dangerous point if the exposure be prolonged. The chief secondary effect of the general application of heat is increased elimination of effete matters from the body. Dry heat is generally more effective than moist heat, since it induces more copious perspiration.

In sudden failure of the circulation, such as occurs in shock and collapse, the general application of heat not only serves to raise the body-temperature, but also acts as a powerful cardiac and vasomotor stimulant.

**Therapeutics.**—Heat, both dry and moist, makes a valuable local application in a large number of *acute inflammatory diseases*. Generally, it may be used interchangeably with cold, the chief guide in the selection of one or the other being the feelings of the patient. Moist heat in the form of fomentations or hot baths is a valuable adjuvant to morphin in relaxing the spasm of unstriped muscles which occurs in *intestinal*, *biliary*, and *nephritic colics*, in *spasmodic croup*, and in *retention of urine*. Hot baths are also useful in breaking up *general convulsions*, especially those occurring in children. Hot foot-baths, through their reflex effect upon the circulation, often afford relief in *cerebral congestion*, *acute coryza*, and *amenorrhea from exposure to cold*. In *acute and chronic parenchymatous nephritis* hot-air baths, hot-packs, and hot-water baths are of the greatest service in producing diaphoresis, especially when there is dropsy or uremia. Mention has already been made (p. 488) of the efficacy of warm effervescent baths in certain cases of *chronic heart-disease*. The continuous immersion of the patient in a warm bath (90°–100° F.—32°–38° C.) has been found useful in *extensive burns* and in some cases of *phagedena*. A course of Turkish baths is frequently beneficial in *chronic gout*, in *chronic rheumatism*, and in the early stages of *chronic Bright's disease* and *diabetes*.

In conditions attended with subnormal temperature, such as *surgical shock* and *collapse from disease* or *poisoning*, the general application of heat, especially in the form of the hot bath, is the most important factor of the treatment.

The local application of intense dry heat (250°–350° F.—121°–177° C.) by means of some such apparatus as was invented by Tallerman, in 1893, is often very advantageous in certain affections of the joints, especially in *chronic synovitis*, *traumatic arthritis*, *sprains*, *tendinous inflammations*, and in the after-treatment of *fractures* and *luxations*. In *subacute* and

*chronic rheumatism* it is also occasionally useful, but in *rh matoid arthritis* it is of little value.

## HYPODERMOCLYSIS AND INFUSION.

Hypodermoclysis and infusion are the introduction, into subcutaneous tissues and blood-vessels, respectively, of w saline solutions in considerable quantities. These procedu first brought prominently forward by Cantani during cholera epidemic of 1892, have been found of great valu a number of conditions. They serve to restore vascular ness when, from any cause, the volume of blood has b much reduced, to stimulate the heart, especially when car failure is associated with arterial depletion, to dilute any t substances that may be present in the blood, and to elimi toxic substances by promoting diuresis.

In *hemorrhage* the injection of a saline solution affor potent means of rapidly restoring the volume of blood. possesses most of the advantages of transfusion without it tending disadvantages.

Hypodermoclysis or infusion has proved very benefici many severe *toxemic conditions;* thus, it has been found ef cious in *uremia*, *diabetic coma*, *puerperal eclampsia*, *septice* and *pneumonia*. It has given good results also in *cho thermic fever*, and extensive *burns*. In some cases of ure eclampsia, pneumonia, and thermic fever it is more effecti preceded by venesection. Lastly, it is exceedingly usef combating the profound vasomotor paresis of *shock*. solution usually employed for these injections is a decino salt solution (0.6 per cent.). This solution is selected bec it corresponds closely in saline strength to the blood-se It may be prepared by adding a heaping teaspoonful of to a quart or a liter of water, boiling, and filtering. Var other formulæ, some quite complicated, have been sugges but they seem to possess no advantages over the one mentioned. Plain water cannot be used for infusion account of its solvent action on the blood-corpuscles.

When the circulation is fairly active and there is no g emergency, hypodermoclysis should be practised in prefer to infusion, the injection being made in the cellular tissu the iliolumbar region, chest, abdomen, or thigh. The fluid r be introduced by means of a fountain syringe to the tube which has been attached an aspirating needle of mode

size. The apparatus, the hands of the operator, and the region selected for the puncture should be thoroughly sterilized. The bag should be suspended 2 or 3 feet above the patient, and the solution should flow from the needle while the puncture is being made. The fluid should enter the tissues at a temperature of about 105° F. (40° C.), and to insure this a temperature of 110° F. (44° C.) should be maintained in the bag. The quantity of fluid required varies from 8 ounces (236.0 c.c.) to a pint (0.5 L.) in toxemic conditions, and from a pint (0.5 L.) to a quart (1.0 L.) or more in severe hemorrhage or shock. Frequently, better results are obtained by injecting smaller quantities several times than a larger quantity at once. In children from 2 to 4 ounces (60.0–120.0 c.c.) are usually sufficient. The rapidity of absorption varies with the state of the circulation, from twenty minutes to an hour being required to introduce a pint of fluid. To prevent overdistention of the tissues, the fluid should be made to enter slowly, gentle friction being applied to aid absorption.

In cases of emergency, when the circulation is very feeble and absorption is nearly at a standstill, intravenous infusion affords a more rapid means of filling the vessels and stimulating the heart than hypodermoclysis. For infusion the apparatus may consist of a graduated glass irrigating jar, having a capacity of about 2 quarts (2.0 L.), and provided with rubber tubing. To the latter should be fitted a fine transfusion cannula having a blunt, oblique tip. In great emergency a glass funnel, a rubber tube, and an aspirating needle will suffice. The reservoir should be placed about 2 feet above the patient, and its contents should be constantly maintained at a temperature of about 110° F. (44° C.), or higher (115° F.—46° C.) in cases of profound shock. The operation is performed as follows: The arm is prepared as for venesection, a fillet being applied securely some distance above the elbow. A prominent vein, preferably the median basilic or the basilic, is then exposed by dissection, and a ligature tied around it at the distal end of the wound. A second ligature is placed around the vessel at the proximal end of the wound, but it is not tied. The vein is next incised between the ligatures, and the cannula, while fluid is escaping from it, is carefully inserted into the lumen of the vein and tied in place by the second ligature, after which the fillet is *immediately* removed. From ½ pint to 2 pints or more (236.0—1000.0 c.c.) may be infused, according to the condition of the patient. The rate of flow may be regulated by raising or lowering the reservoir or by means

of a clamp attached to the tubing. At least ten minutes shou be allowed for introducing each pint of fluid. If care be tak to expel all air from the tubing and cannula before inserting t latter, the danger of air-embolism need not be feared.

Shortly after infusion a rigor may occur, and the pulse a respiration may become more rapid; usually, however, th untoward symptoms gradually disappear and are followed distinct improvement.

## ENTEROCLYSIS.

By enteroclysis is meant the irrigation of the colon v large quantities of water, the latter being either plain or m cated, hot or cold, according to the effect desired. It is p tised for a number of purposes: To cleanse the colon bring remedies in direct contact with the lower bowel in eased conditions; to raise or lower the body-temperature stimulate the heart in shock or collapse; to restore wate the blood in anhydremia; to promote renal secretion; dilute poisonous substances that may be present in the bl to check intestinal hemorrhage; and to relieve intussus tion.

In some cases of *indigestion with persistent constipation* e lent results may be obtained by thoroughly irrigating the b once daily or every other day, with several quarts of wat from 90° to 70° F. (32°–21° C.). In *acute catarrhal dyse* injections of a warm (103° F.—39.5° C.) solution of boric (1 dram to 1 quart—4.0 gm. to 1.0 L.), continued until the returns from the bowel clear, often affords much relief. *amebic dysentery* quinin (1 : 5000 to 1 : 2000) may be stituted for the boric acid. In *chronic dysentery* no treat is so generally successful as intestinal irrigation with solutions of silver nitrate (see p. 372). In *enterocoliti cholera infantum* high enteroclysis, once or twice a day, normal salt solution, is a valuable adjuvant to other t peutic measures. If the child's temperature is high water may be at 90° F. (32° C.) or lower; if, how there is a tendency to collapse, the water may be at 10 (40° C.). Cantani and others have spoken highly of e clysis with hot tannic acid solutions (2 per cent.) as an hypodermoclysis in *Asiatic cholera*.

Intestinal irrigation with hot salt solution (105°–110° 40°–43.5° C.) for half an hour to an hour is a potent rem *shock*. It may be practised also as a preventive meas

the condition of the patient prior to a surgical operation is such that shock is to be feared. Hot saline injections are very valuable, too, in *anuria* resulting from nephritis or following operation. In *uremia* they tend not only to promote renal secretion, but also to dilute the poisonous substances circulating in the blood. Some practitioners speak favorably of very hot rectal injections (110° F.—43.5° C.) in *hemorrhage from the stomach or bowel.* The continuous administration of salt solution, drop by drop, by the rectum has given good results in *acute peritonitis.*

Daily irrigation with cold water—70° F. (21° C.) or lower—has been found quite effective in some cases of persistent *catarrhal jaundice.* Enemata of cold water (60°–50° F.—15.5°–10° C.) may be used successfully in connection with ice-baths to lower the temperature in *thermic fever.*

Recent cases of *intussusception* are sometimes relieved by high rectal injections, but the hydrostatic pressure must not be too great, otherwise rupture of the bowel is liable to occur. The child should be anesthetized and the colon thoroughly but very gradually distended with warm water, the elevation of the reservoir not being over 3 or 4 feet.

Enteroclysis may be practised by means of an ordinary fountain syringe to which has been adjusted a flexible colon tube, or, for children, a soft-rubber catheter (No. 20). If the latter be used, an extra eye should be cut in it near the tip. The requisite pressure is secured by elevating the water-bag 3 or 4 feet above the patient. The return flow may be collected in a bed-pan or, better, it may be conducted, by the aid of a rubber sheet, into a bucket placed on the floor. The patient having been placed in the dorsal position with the hips elevated, the tube should be well lubricated and gently inserted from 12 to 18 inches in the adult, or 10 to 14 inches in the child, and the water turned on. In the adult from 1 pint to 3 pints (0.5–1.5 L.), and in the child from ½ pint to 2 pints (0.3–1.0 L.), of water should be allowed to enter the bowel, when the tube of the fountain syringe should be detached from the rectal tube, thus permitting a return flow to occur.

While a long single tube used in the way just described gives excellent results, a double-current tube will be found far more convenient, especially for continuous irrigation. A good example of the double-current tube is the one devised by Dr. R. C. Kemp.

## LAVAGE OF THE STOMACH.

There are two methods of washing out the stomach—one, by the stomach-pump; the other, by siphonage. The stomach-pump is simply a syringe with two apertures instead of one, in which are adjusted valves opening in opposite directions. By connecting the syringe alternately at each of these apertures with an incompressible tube passed into the stomach, the gastric contents may be drawn out or fluid may be introduced into the stomach.

Washing out the stomach by siphonage may be accomplished in one of two ways: In the first a large glass funnel, to which is attached a rubber tube about 2½ feet (45.7 cm.) long, is joined through the medium of a short piece of glass tubing to a previously passed stomach-tube. The requisite amount of water, usually about a pint (0.5 L.), is poured into the funnel, which is then elevated sufficiently to allow the water to flow into the stomach. Before the funnel is empty, however, it is quickly depressed, so that the water is returned from the stomach by siphonage. The escape of the fluid from the stomach may be further facilitated by the application of gentle pressure to the epigastrium. The process should be repeated until the water returns clear.

In the second method the free end of the stomach-tube is connected with a Y-shaped glass tube, to one limb of which is attached a rubber tube leading to an elevated reservoir containing water, while to the other limb is attached a rubber tube leading to a pail placed on the floor. By alternately opening and closing the two external tubes by means of clamps the water may be made to flow into or out of the stomach.

The siphoning apparatus, on account of its simplicity and safety and the ease with which it can be manipulated, even by the patient himself, has almost completely supplanted the stomach-pump. The latter may be used with advantage, however, when the stomach contains much coarse solid matter or when it is necessary to remove the gastric contents very promptly and thoroughly.

No other lubricant than water is required for the stomach-tube. The introduction of the tube is facilitated by having the patient breathe deeply and make repeated efforts at
llowing as soon as the tube reaches the posterior wall of
pharynx. Cocainization is sometimes employed to allay
eme sensitiveness of the pharynx, but it is rarely neces-
. To prevent the tube from being completely swallowed,

it may be secured by means of a string attached to its distal extremity.

Ordinarily, the water used for lavage may be unmedicated; when, however, there is abundant mucus in the stomach, 2 per cent. of sodium bicarbonate may be added with advantage. Potassium permanganate (1 : 5000), sodium salicylate (1 : 100), or sodium hyposulphite (1 : 100) may be used when there is excessive fermentation.

The most important indication for lavage is *retention of food with fermentation*. Thus, in organic stenosis of the pylorus thorough washing of the stomach two or three times weekly, or every day in some cases, preferably before breakfast, affords great relief. In *atonic dilatation with fermentation* lavage is also efficacious. In *acute food-poisoning* and *toxic gastritis* it is often better to resort to the tube than to employ an emetic.

In *chronic gastric catarrh*, when there is an *excessive secretion of mucus* it is often of service; in other cases, however, it does no good, and is, according to Boas, absolutely contraindicated. Practised promiscuously in cases of simple gastric catarrh, it is capable of doing considerable harm and of developing into a most pernicious habit. In *supersecretion of acid* (Reichmann's disease) washing out the stomach with a solution of sodium bicarbonate (2 per cent.) or silver nitrate (1 : 5000 to 1 : 2000) sometimes gives good results. Kussmaul and others have found lavage of the stomach very beneficial in *acute intestinal obstruction*. In this condition it serves to allay vomiting, to lessen the pressure in the bowel, and to diminish the violent peristalsis.

Lavage is contraindicated in peptic ulcer, in ulcerating carcinoma, especially when accompanied by much bleeding, and in gastric catarrh associated with atrophic cirrhosis of the liver. It should be avoided also in advanced pregnancy, in aortic aneurysm, and in aged persons with marked arteriosclerosis.

## BLOODLETTING.

Bloodletting is employed both as a local and as a general remedial measure. As a local measure it may be practised by cupping or by leeching, and as a general measure by venesection.

**Cupping.**—There are two methods of cupping—the dry and the wet. In dry cupping the blood is not shed, but is diverted by atmospheric pressure from the deeper parts to the cutaneous surface. A small quantity, however, is actually drawn from the vessels into the cellular tissue of the skin. The

special instrument used for cupping consists of a glass bell wi an aperture at its summit, through which is extracted the a by means of a pump or rubber ball. In the absence of su an instrument an ordinary tumbler will serve the purpose. small piece of blotting-paper moistened with alcohol is plac in the bottom of the tumbler and lighted. While the paper still burning the glass is inverted and applied firmly to the sk The flame is immediately extinguished, and the air being e hausted, the skin in the interior rises in the cup and becon of a dark-red color. To avoid burning the skin, it is necessa to allow all excess of alcohol to run out of the tumbler bef igniting the paper. From one to a dozen of these cups m be applied, and they may be allowed to remain in position from five to ten minutes. The cup can be readily removed making a little pressure near the rim so as to allow ai enter. The same method is pursued in wet cupping, exc that numerous small incisions are made in the skin by me of a scarificator before the cup is applied. As scarificat leaves permanent cicatrices, wet cups should not be applied exposed surfaces. Dry cupping is not so efficient as wet c ping, but may be practised when the patient's strength will warrant an absolute loss of blood.

**Leeching.**—Leeches accomplish the same purpose as cups, but on account of their size and shape they can applied to parts to which cups cannot be adjusted, as beh the ears, about joints, over the spermatic cord, and the ve of the anus. Each leech, according to the variety emplo removes from 1 to 3 drams (4.0–11.0 c.c.) of blood. Lee should be applied in the neighborhood of inflamed parts, directly over them, and parts which are abundantly supp with loose areolar tissue, like the eyelids and the scrot should be avoided. The eye may be depleted from temple, and the testicle from the perineum. Before le ing, the part should be shaved and well washed, care b taken to remove all soap.

Leeches may be applied with the finger or by means an inverted wine-glass or pill-box. A little blood or w milk smeared over the skin will generally induce them to if they are not disposed to do so. They should not be tached forcibly, but allowed to drop off themselves, or m to relinquish their hold by sprinkling them with salt. desirable, bleeding from the bites may be encouraged applying warm fomentations. Occasionally, owing to presence in the tissues of a large quantity of the anti-co lant substance secreted by the leech, the hemorrhage pr

very persistent, and requires for its arrest the application of firm pressure, of some styptic (ferric subsulphate or alum), or of the actual cautery. Like scarifying, leeching leaves indelible scars.

Local bloodletting may often be practised with advantage in the early stage of many acute inflammatory diseases, such as *pneumonia*, *nephritis*, *orchitis*, etc. At the onset of acute inflammation of serous membranes,—*pleuritis*, *pericarditis*, *iritis*, *synovitis*, and *meningitis*,—especially when the symptoms develop abruptly and are very severe, it may be of the greatest value in relieving pain and in repressing exudation. In *acute pulmonary edema with cyanosis* wet cupping is of service, although it is not generally so useful as venesection.

**Venesection or Phlebotomy.**—The general abstraction of blood is accomplished by incising a vein. The patient having been placed in a semirecumbent position, the arm should be constricted a few inches above the elbow by a twisted handkerchief or a few turns of a roller bandage. If this is not sufficient to render the veins prominent, the arm may be rubbed for a few minutes from below upward. A large vein (median cephalic or median basilic) having been selected, it should be fixed by the thumb of the left hand below the point of section, and then incised by a lancet or bistoury in a direction oblique to the long axis of the vessel. The pulse should be carefully observed during the operation, and when it lessens in force or becomes more compressible, the bleeding must be suspended. The loss of blood required to afford relief varies in different conditions from a few ounces to a pint or more. To arrest the flow, it is only necessary to remove the fillet from the arm and to apply a small compress and figure-of-eight bandage.

The cases in which venesection is indicated are those in which life is immediately endangered by some circulatory obstruction or by toxemia. In *overdistention of the right ventricle*, whether from mitral disease, pneumonia, or emphysema, when there is a small, weak pulse, with cyanosis and orthopnea, the venous engorgement is often most promptly and effectually relieved by the abstraction of a few ounces (10–20) of blood. In *cerebral hemorrhage*, when the pulse tension is high and there are evidences of pronounced hyperemia of the brain, venesection is advisable. In *aortic aneurysm*, when the heart-action is strong and there is severe pain, bleeding often affords great relief.

In *acute uremia* and *puerperal eclampsia* venesection affords the most rapid means available of removing toxic substances

from the body. It may be practised advantageously in co nection with subcutaneous and rectal injections of normal s solution.

Packard and others have found bloodletting (10–20 ounc efficacious in *grave cases of thermic fever*. Feebleness of pulse is not necessarily a contraindication, as the circulat often improves as the blood flows from the arm.

## ACTINOTHERAPY.

The method devised by Finsen of treating certain locali diseases of the skin by means of concentrated rays of eit sunlight or electric arc-light has met with considerable s cess. It is based upon three postulates proved exp mentally by Widmark, Finsen, Bie, and Godneff: the po of the chemical rays to penetrate the skin; the bacteric properties of these rays; and the power of the chemical r to excite an inflammatory reaction in the skin. Finsen's paratus is constructed to accomplish the following objects concentrate the light, to absorb or to exclude most of heat-rays (ultra-red, red, and yellow) without impairing chemical rays (ultra-violet, violet, and blue), to keep the cool, and to render the tissues anemic. The last is neces to secure penetration of the chemical rays.

The apparatus for sunlight consists of a lens from 8 t inches (20.0–40.0 cm.) in diameter. This lens is composed two glasses, one curved and the other plain, adjusted brass ring and separated from each other by a weak am niacal solution of copper sulphate. The blue liquid does affect the chemical rays, but it cools the light by arresting heat-rays. The apparatus for sunlight consists of two qu lenses framed in two brass tubes, which can be moved the into the other, like the two pieces of a telescope. The le are separated from each other by a space filled with dist water, and in order to prevent overheating of the latter by absorption of the ultra-red rays cold water is made to ci late through a mantle surrounding this section of the t In both plans heating of the skin is further avoided by n ing cold water run through a hollow quartz lens, whic applied to the affected part with sufficient pressure to m the tissues anemic.

Excellent results have been achieved by the light treatm in *epithelioma of the skin*, *lupus vulgaris*, and *lupus erythe tosus*. In a few cases of *alopecia areata* in which it has b tried the results have also been encouraging. Relapses

said to be rare, and the applications are painless. Apart from the expense of the apparatus and the necessity of trained assistants, the main drawback to the light treatment is its duration. Daily sittings, each lasting an hour, are required for periods ranging from several weeks to a year or more.

## RÖNTGEN RAYS.

It has been shown conclusively that Röntgen rays exert a curative influence in certain diseases equal to, if not greater than, that of the concentrated chemical rays of light. The action of the two forces, however, is not exactly the same. Röntgen rays differ from actinic rays in having greater penetrating power, in acting not only upon the skin but also upon the deeper structures; in having no bactericidal power; in being able to effect curative changes without producing any conspicuous inflammatory reaction; and in rendering the tissues more sensitive to their influence the more frequently they are applied. The nature of the changes effected by Röntgen rays in animal tissues is obscure; but some recent investigations support the view that they stimulate autolysis and thus bring about the destruction of the cells. In experiments on mice, rabbits, and dogs, Heinke found that exposure of the abdomen to the rays induced transient retrograde changes in the nuclei of the spleen, mesentery glands, and other lymphatic structures. Perthes found that fertilized ova of *Ascaris megalocephala* when exposed to *x*-rays developed into imperfect embryos. Gilman and Baetjer state that chicks developed in eggs exposed to the rays also show deformities. Albers-Schönberg has demonstrated that the prolonged exposure of animals to the rays causes sterility by killing the spermatozoa. Whether the sterility is temporary or permanent he has not determined. Young cells seem to be more sensitive to the rays than old ones. This probably explains the greater influence of the rays on new growths than on the adjacent healthy tissues.

Röntgen-ray treatment has been found extremely valuable in *superficial cancer*, *lupus vulgaris*, and *acne*. It has given good results also in some cases of *eczema*, *hypertrichosis*, *ringworm*, *localized pruritus*, *blastomycosis*, *mycosis fungoides*, and *keloid*. The chief drawbacks of the treatment are its tediousness and the possible danger of producing serious Röntgen-ray burns.

In *subcutaneous, deep-seated carcinomas* the effect of the rays is scarcely more than palliative. Pusey gives a just estimate of their value in the following propositions: "In all cases of malignant disease which have been operated on there is reason to urge the subsequent use of the *x*-rays as a prophylactic measure. In all inoperable cases of malignant disease the *x*-rays should be tried. In such cases there is a probability of relieving pain and a possibility of inhibiting the progress of the disease."

In *leukemia* and *pseudoleukemia* great improvement and even symptomatic cure very frequently follows prolonged treatment by Röntgen rays. Relapse, however, is to be anticipated, as actual cure probably never occurs. To secure good results in the various diseases in which *x*-rays are indicated the applications should be made every two or three days, and continued for several weeks or months. The exposures should last from five to twenty minutes, the cutaneous surface adjacent to the diseased area being protected by lead sheathing. The appearance of even the slightest erythema is to be regarded as an indication for interrupting the sittings. In skilled hands the risk of causing *x*-ray burns is slight.

## RADIUM.

The salts of radium (bromid and chlorid) give out three kinds of rays, known as the *alpha*, *beta*, and *gamma* rays. *Alpha* rays constitute the largest part of the radiation, are slightly deflected by the magnet, have little penetrative power, and do not escape beyond the glass tube in which the radium is enclosed. The *beta* rays are strongly deviable by the magnet, but in a direction opposite to that of the alpha rays, have greater penetrative power than the latter, and are very similar to the kathodal rays from a Crookes tube. The *gamma* rays exist in smaller proportion than the others, are non-deviable, possess great penetrative power, and are similar to the Röntgen rays. The activity of a specimen of radium is estimated by the rapidity with which it discharges a gold-leaf electroscope, the standard unit of time being that required for the discharge of such an electroscope by metallic uranium. If the specimen discharges the instrument in one-thousandth the time required by uranium, the strength is taken as 1000 units. Specimens of high strength are generally used—anywhere from 200,000 to 1,500,000 units.

The therapeutic uses of radium rays have been shown to

follow the same lines as those of the Röntgen rays. Occasionally they may prove more effective than the latter, but, on the whole, they are distinctly less useful. They are well suited, however, for application to certain places, like the esophagus, which are inaccessible to *x*-rays. As they are capable of producing severe burns, and even ulcers, they require the same careful handling as the *x*-rays.

## LUMBAR PUNCTURE.

The procedure known as lumbar puncture consists in the removal of cerebrospinal fluid through a hollow needle introduced between the transverse processes of the lumbar vertebræ. Since 1891, when it was first resorted to by Quincke, for the relief of excessive intracranial pressure in cases of chronic hydrocephalus, it has been rather extensively practised not only as a therapeutic measure, but also for diagnostic purposes. The operation consists in introducing a needle from 5 to 8 cm. long between the third and fourth lumbar vertebræ, and from 5 to 10 mm. to one side of the median line. The needle should be directed slightly upward and toward the median line. The required depth of the puncture can be determined by the sense of touch, the disappearance of resistance indicating the entrance of the needle into the cavity. In children the fluid is usually reached at a depth of from 2 to 3 cm., and in adults at from 4 to 6 cm. It is better to allow the fluid to run from the needle than to aspirate. From 10 to 60 c.c. of fluid may be removed, the amount depending largely upon the age of the patient and the nature of the disease under treatment. On the occurrence of faintness, headache, or a change in the character of the pulse, the needle should be immediately withdrawn.

The chief therapeutic indication for lumbar puncture is to relieve excessive pressure by the cerebrospinal fluid on the brain and cord. Repeated at frequent intervals, it has given very encouraging results in cases of *acute cerebrospinal meningitis*. Koplik has reported 4 recoveries in 5 cases of meningitis due to the meningococcus in which this treatment was employed, and Netter has reported 7 recoveries in 11 cases of purulent meningitis in which lumbar puncture was done from 1 to 10 times and warm (104° F.—40° C.) baths were given every three or four hours. In *tuberculous meningitis* it may be practised as a palliative measure when the pressure-symptoms are very severe. In *chronic hydrocephalus* it is of doubtful value,

although in some instances it appears to have afforded temporary relief. A number of observers (Quincke, Furbringer, von Leyden, Carriere, and Buzzard) have found it very effective in *acute uremia.*

Jacoby has reported 2 cases of *traumatic paraplegia* in which rapid improvement followed the removal by puncture of bloody fluid. The operation is contraindicated in tumor of the brain, softening, apoplexy, and embolism. There are on record at least 5 cases in which sudden death was induced by lumbar puncture in brain-tumor.

# APPLIED THERAPEUTICS.

## ACUTE INFECTIOUS DISEASES.

### TYPHOID FEVER.

As soon as the nature of the disease is recognized, the patient should be confined to bed. The room should be large and airy, and provided with efficient means of securing thorough ventilation. The temperature of the room should be maintained between 65° and 70° F. (18.5°–21° C.). The bed should be moderately firm. The mattress should be protected by a rubber cloth spread beneath the sheet, and the latter should be kept smooth to guard against the development of bed-sores. Even in mild cases it is advisable to have a nurse or attendant constantly at hand, for accidents resulting from sudden delirium are liable to occur. The mouth and teeth should be washed several times a day with a solution of boric acid (10 gr. to the oz.—0.6 gm. to 30.0 c.c.). The bed-pan must be used from the beginning until convalescence is well advanced. The stools and urine should be rendered innocuous before being disposed of. This may be done by treating the evacuation with twice its volume of a 1 per cent. solution of chlorinated lime or a 5 per cent. solution of carbolic acid, and allowing it to stand in a covered vessel for two hours before emptying it into the closet. Soiled clothing should be thoroughly boiled.

**Diet.**—The diet should be liquid or semisolid, unirritating, and easily assimilable. As a rule, milk is the best food. Most patients will be able to take from 2 to 4 pints (1.0 to 2.0 L.) in the twenty-four hours, given in portions of from 4 to 6 ounces (120.0–175.0 c.c.) every two or three hours. It is generally advisable to dilute the milk with lime-water. If curds appear in the stools, the quantity of milk should be reduced. Among other permissible articles may be mentioned buttermilk, koumiss, junket, milk-whey, albumin-water, raw eggs, oyster, mutton, or chicken broths, chicken jelly, and consommé. Cocoa, iced tea, ice-cream, wine-jelly, blanc-mange, and, unless diarrhea is present, strained fruit-juices may be given occasionally to vary the monotony of the diet. Most clinicians are of the opinion

that the return to solid food should not be commenced ur
the temperature has been normal a week or ten days. Tl
is a good general rule, but it is open to many exceptions.
some cases it is advisable to wait longer than the period nam
before permitting solid food; in others it is not only safe, b
advantageous, to administer more substantial food some ti
before convalescence has actually begun.

Cold water or cracked ice may be given freely, and one
the other should be offered to the patient several times a c
even though he may not ask for it. It is rarely advisable
awaken the patient out of a sound sleep to give him eitl
nourishment or medicine, but when there is stupor, he sho
be aroused at stated intervals.

**Stimulants.**—Stimulants are not always required, but wl
the pulse becomes soft and the first sound of the heart in
tinct, alcohol should be given tentatively, its effects being c
fully noted.

Ordinarily, the best form of stimulant is whisky or bran
occasionally, however, sherry, port, or champagne may
better borne. At first 1 or 2 ounces (30.0–60.0 c.c.) of whi
in the twenty-four hours may be quite sufficient; later it
be necessary to increase the amount to 10 or 12 ounces (29
355.0 c.c.) or more. The quantity must be determined in e
case by the effect. If the pulse becomes stronger, the ton
less dry, the mind clearer, and the urine more copious u
the administration of the stimulant, it is doing good; if, h
ever, opposite effects are observed, it is doing harm, at lea
the quantity in which it is being employed.

Generally, the alcohol should be given with the milk, so
it may serve as an aid to digestion, but when the sympt
are very severe, it may be given also at other times.

**Special Remedies.**—Various antiseptics have been re
mended from time to time with the object of destroying
typhoid bacilli or of rendering them harmless. Thus calc
corrosive sublimate, carbolic acid, iodin, chlorin water, thy
$\beta$-naphthol, salol, and guaiacol have each had their advoc
While certain of these agents may at times be useful in ch
ing excessive fermentation in the intestinal canal, the evid
is far from convincing that they exercise any modifyin
fluence upon the systemic infection itself.

While antityphoid inoculations have been practised
encouraging results in preventing the occurrence of typ
fever, the employment of antityphoid serum as a curative
has been thus far on too limited a scale for any opinion
formulated as to its efficacy.

**Pyrexia.**—High temperature is controlled best by the

bath or the cold pack; these hydrotherapeutic measures not only reduce the temperature, but they also exert a powerful stimulant influence upon the nervous system and the circulation, and in many instances have a diuretic effect. Excellent results have been obtained by using the cold bath throughout the attack as often as the temperature in the mouth rises to 102.5° F. (39.2° C.). (See Cold.) The total mortality under hydrotherapy in a series of 1904 cases treated by J. C. Wilson in Philadelphia was 7.5 per cent.—exactly the same as that in 1902 cases treated by F. E. Hare in the Brisbane Hospital, Australia. As the death-rate under the expectant treatment is between 14 and 15 per cent., it would appear that systematic cold bathing has reduced the mortality about 50 per cent.

When the baths are inapplicable, the fever may be kept within safe limits by cold sponging or the cold pack. Occasionally it may be necessary to administer a small dose of phenacetin or of antipyrin (5 gr.—0.3 gm.), but these drugs should never be used in large doses or given repeatedly.

**Heart-failure.**—Cold bathing and the timely use of alcohol do much to guard against heart-failure. When the tendency to cardiac failure is pronounced, strychnin may be given in doses of $\frac{1}{40}$–$\frac{1}{20}$ gr. (0.0016–0.0032 gr.) every three or four hours. In severe cases the drug should be given hypodermically. Digitalis or strophanthus may also be tried, but in the presence of fever these remedies often prove ineffectual. Salt solution, given by the bowel or, if necessary, subcutaneously or intravenously, sometimes renders valuable aid in combating the effects of the toxemia on the circulation. If collapse is threatened, ether, alcohol, or, better still, camphor (1–2 gr.—0.06–0.13 gm.) may be given subcutaneously at frequent intervals.

**Diarrhea.**—When the diarrhea exceeds three or four stools a day, efforts should be made to check it. In some cases a modification of the diet—reducing the quantity of milk, peptonizing the milk, or limiting the diet to albumin water alone—will be all that is required. In other cases it may be necessary to use a suppository or enema of opium once or twice a day. If the diarrhea be troublesome, bismuth subnitrate or silver nitrate may be given by the mouth in combination with opium:

℞ Morphinæ sulphatis, gr. j (0.065 gm.);
Salolis, ʒss (2.0 gm.);
Bismuthi subnitratis, ʒiij (12.0 gm.). M.
Fiant chartulæ No. xv.
Sig.—One powder every three or four hours.

℞ Argenti nitratis, gr. iij (0.2 gm.);
Pulveris opii, gr. vj (0.4 gm.). M.
Fiant pilulæ xii.
Sig.—One pill every three or four hours.

In very obstinate cases copper sulphate with opium in p proves efficacious.

**Constipation.**—Constipation lasting but two or three da requires no special treatment. Sometimes meat broths strained oatmeal gruel given alternately with the milk w exert a mild laxative effect. When more than a modificati of the diet is necessary, an enema of soapy water or glyce should be tried before resorting to remedies by the mou In obstinate cases small doses of calomel, of Epsom salt, or castor oil may be given at short intervals until the desi effect is obtained.

**Tympanites.**—Troublesome tympanites is often entir overcome by substituting albumin and water for milk. In ot cases it may be relieved by the external application of turpent stupes and by the internal administration of some antise remedy, such as turpentine, beta-naphthol, beta-naphthol muth, creosote, or salol. Enemas of turpentine or of a fœtida are also efficacious. In certain persistent cases, ap ently paretic in nature, the author has successfully emplo eserin salicylate in doses of $\frac{1}{60}$–$\frac{1}{40}$ gr. (0.001–0.0016 gm.) or three times daily, as recommended by von Noorden. ally, when the tympanites is extreme and other measures h failed to afford relief, a soft rectal tube may be introduced far as possible into the colon.

**Persistent Vomiting.**—When the stomach is excessiv irritable, it is better to withhold milk for a time and to in its stead albumin and water in small quantities frequent intervals. Occasionally it may be necessary withhold all food by the mouth for twenty-four hours an support the patient by rectal alimentation. The best ga sedative in such cases is bismuth subnitrate in powder, cerium oxalate or cocain hydrochlorid, or in water with di hydrocyanic acid. A mustard-plaster to the epigastriun often efficacious.

**Hemorrhage from the Bowels.**—The patient mus kept at absolute rest. Cold bathing must be suspended. the hemorrhage is severe, the bowel-movements shoul received in a folded towel instead of in a bed-pan. An ice may be applied with advantage to the right iliac region, ice may be given by the mouth. It is advisable slightl elevate the foot of the bed. For ten or twelve hours the ment should be reduced to the smallest possible amount. best drug is opium; it controls peristalsis and allays ex ment. Oil of turpentine, in doses of from 10–20 min. (0.6–1.2

every two hours, is also efficacious. Some writers speak favorably of oil of erigeron. Preparations of ergot are of no value. In cases of recurrent hemorrhage gelatin (see p. 381), subcutaneously or by the bowel, should be tried. Rectal injections both of iced water and of very hot water (110° F.—43.5° C.) have been recommended. If collapse is threatened, diffusible stimulants, like ether and alcohol, should be given freely. The acute anemia following copious bleeding is best treated by subcutaneous or intravenous injections of warm saline solutions (see p. 496).

**Headache.**—In most cases absolute rest, quiet, and cold applications to the head suffice. If the pain is severe, it may be necessary to give sodium or potassium bromid (10–15 gr.—0.65–1.0 gm.) or small doses (5 gr.—0.3 gm.) of phenacetin.

**Insomnia.**—Opium is generally the best hypnotic. In some cases, however, sodium bromid or chloralamid acts better. Chloral is also very efficacious, but it should not be used when the heart is weak.

**Delirium** is best managed by hydrotherapy. Low, muttering delirium usually calls for stimulants. An ice-cap is useful. Camphor or musk may be tried; the former is best given hypodermically, the latter by the bowel. In active or violent delirium no drug is so generally useful as morphin. In some cases hyoscin ($\frac{1}{100}$–$\frac{1}{100}$ gr.—0.00043–0.00064 gm.) acts well.

**Hypostatic Congestion of the Lungs.**—Frequent change of position and the timely use of cardiac stimulants will frequently prevent serious pulmonary congestion. When severe enough to embarrass the respiration and circulation, dry cups or stupes should be applied to the chest, and strychnin or ammonium carbonate given internally. In grave cases oxygen inhalations afford relief, but their effects are usually temporary.

**Perforation.**—Recovery from peritonitis is so exceedingly rare under medicinal treatment that operative interference is called for in all cases which are not obviously moribund. The operation should be done at the earliest possible moment. Mauger reports 25 recoveries in 107 cases, and Harte and Ashhurst 362 cases with 94 recoveries. From these statistics operation appears to save life in from 20 to 25 per cent. of the cases.

**Bed-sores.**—This complication can usually be prevented by absolute cleanliness, frequent change of position, the appli-

cation of whisky or whisky and alum to parts most subjected to pressure, and the timely use of a water-bed or of air-cushions. Slight abrasions may be painted with flexible collodion or dusted with a powder of bismuth subnitrate and iodoform or of boric acid and starch. When there is great difficulty in keeping the parts dry, zinc ointment may be freely applied. Ulcers should be washed with weak antiseptic lotions, dusted with some antiseptic powder like iodoform or iodol, and then protected by a large piece of soap-plaster. An ointment of balsam of Peru (1 : 30) is sometimes very efficacious.

## TYPHUS FEVER.

As typhus fever is a contagious disease, the patient must be isolated and every precaution must be taken to prevent the dissemination of the morbific agent, whatever it may be. Those who have had experience in typhus epidemics assert that free ventilation is often in itself sufficient to arrest the transmission of the disease. There is no specific treatment. The diet should be nutritious and easily assimilable. As in other continued fevers, liquids are better borne than solids, although special precautions are not so imperatively demanded as they are in typhoid fever. The pyrexia, nervous phenomena, heart-failure, and pulmonary congestion will require the same treatment as in typhoid fever.

## RELAPSING FEVER.

As in all contagious diseases, isolation, free ventilation, and disinfection of excreta and clothing are important safeguards against the spread of the virus. The treatment is purely symptomatic. Absolute rest, good nursing, and proper diet will do much to avert complications. The chief indications are to control the fever, to quiet the stomach, to relieve the intense pains in the head, back, and limbs, and to support the heart.

On account of the short duration of the febrile paroxysms the fever itself is not so important a factor as it is in many other acute infections. Ordinarily, the application of ice to the head, with frequent cold sponging of the body, will suffice. Cold baths are not well borne on account of the severe muscular pains. Hyperpyrexia must be controlled by the cold pack and the administration of phenacetin or antipyrin or of large doses of quinin.

Vomiting is sometimes exceedingly difficult to control. Cracked ice, carbonated water, dilute hydrocyanic acid (1–2 min.—0.06–0.1 c.c.), cocain hydrochlorate ($\frac{1}{4}$ gr.—0.016 gm.),

or wine of ipecac (1 min.—0.06 c.c.) should be tried. A mustard-plaster to the epigastrium is sometimes efficacious.

For the relief of the pains, restlessness, and insomnia no drug is so useful as morphin. A quarter of a grain (0.016 gm.) may be given hypodermically two or three times a day. Hot-water bags may also be ordered for the backache, and rubefacient liniments for the muscular pains. Stimulants are not generally required, but when there is any tendency to heart-failure they should be administered freely.

## CEREBROSPINAL FEVER.

Cerebrospinal fever being communicable, the same precautions should be observed as in the case of other serious contagious diseases. The sick-room should be quiet, darkened, and well ventilated. The diet should be liquid and supporting. Milk and animal broths may be given freely at frequent intervals. In some cases, in order to secure the ingestion of enough nourishment, it may be necessary to resort to nutrient enemata or forced feeding by means of a stomach-tube. Cardiac failure must be combated by stimulants, of which the best are whisky and brandy.

The number of patients treated with the antiserum prepared by Flexner (see p. 434) is still too small to justify a positive opinion concerning its exact value and limitations; nevertheless, the reports to date are sufficiently favorable to warrant a thorough trial of the remedy in all cases, even of suspected meningococcic meningitis.

Morphin hypodermically is the best drug for the relief of headache, pain, and restlessness. Chloral, bromids, and phenacetin in safe doses are rarely effective. Cold applied to the head affords some relief. Warm baths (105°–110° F.) twice a day for ten minutes are often very efficacious.

When there are evidences of excessive intraventricular pressure (intense headache, retraction of the head, convulsions, and stupor), the withdrawal of from 30 to 40 c.c. of fluid from the spinal canal sometimes has a happy effect.

After the subsidence of the acute symptoms the absorption of the exudation may be attempted by the administration of potassium iodid. When symptoms indicating pressure on the brain or spinal cord persist, repeated blisters or light applications of thermocautery are sometimes useful. Tonics—iron, strychnin, cod-liver oil—are generally indicated during convalescence. Local palsies will require massage and electricity.

Even after convalescence has been well established all mental and physical excitement should be avoided for a considerable period.

## MALARIAL FEVER.

It has been definitely established that the hemocytozoan discovered by Laveran in 1880 is the sole cause of malarial fever, and that the mosquito plays an important rôle in transmitting the infection. Prophylactic measures include the extermination of mosquitos, the prevention of infection of mosquitos, and the prevention of infection by mosquitos (Manson). The most useful methods of suppressing mosquitos are the efficient drainage of pools and swamps and the cultivation of damp soils. Covering the surface of the water with petroleum will also free pools from larvas for from two to four weeks. To prevent the infection of mosquitos, malarial patients should be carefully screened. The chief means of preventing infection by mosquitos are avoidance of sleeping in the open air, and of exposure to the evening and early morning air, adequate protection from the insects, and the use of quinin in daily doses of from 2–5 gr. (0.13–0.3 gm.).

Quinin is the only reliable remedy for malarial fever. Methylene-blue and Warburg's tincture possess some value, but, being distinctly less efficacious than quinin, they should be employed only when the latter is not well borne. Arsenic is useful in correcting the anemia caused by malarial fever, but it probably has no parasiticidal influence. The methods of administering quinin and other antimalarial remedies has already been considered (see p. 414).

*Symptomatic Treatment.*—During the cold stage of the paroxysms the patient should be well covered with warm blankets and given hot drinks. Opium in the form of paregoric is sometimes useful in mitigating discomfort. It may be combined with a few minims of aromatic spirits of ammonia, chloroform, or Hoffmann's anodyne. Generally, alcoholic stimulants are better avoided, since they tend to increase the severity of the reaction. In the algid type of pernicious malarial fever, however, it may be necessary to give alcohol freely, with digitalis and strychnin, to tide the patient over the paroxysm. In the hot stage much relief is afforded by frequently sponging the body with cool water, giving cold drinks, and administering, if the symptoms are very severe, a small dose of phenacetin.

When the bowels are constipated and the tongue is thickly coated, laxative doses of calomel or of blue-mass may be given with advantage. Vomiting and purging are occasional symptoms; they are best controlled by an opiate.

In the graver congestive type, with coma and high fever, cold bathing and rectal injections of cool water are indicated.

For the anemia following malarial infection arsenic and iron should be given (see p. 311).

Malarial cachexia requires tonic and hygienic treatment. Arsenic, iron, and cod-liver oil are especially valuable. As in other manifestations of malaria, quinin is indicated so long as the blood shows parasites. According to Wood, it is much better to produce distinct cinchonism at intervals than to give the drug continuously in moderate doses. When there is constipation, mild bitter laxatives are beneficial. Change of locality is sometimes necessary to effect a cure. For the enlarged spleen, ergot has been warmly advocated, but it is of doubtful utility.

## INFLUENZA.

Although we possess no certain safeguards against the spread of influenza, yet an effort should always be made to protect healthy members of the household, especially the young, old, and delicate, from infection. To this end the patient should be isolated, and the secretion from the catarrhal surfaces should be thoroughly disinfected.

No specific has yet been discovered for the disease. Hygienic measures are of the first importance; these include immediate and absolute rest in bed, a carefully selected diet, pure air without draft, and attentive nursing. Complications and relapses can generally be traced to a neglect of these rules.

In mild cases little in the way of special treatment is required. A hot foot-bath, some mild refrigerant, such as spirit of nitrous ether or solution of ammonium acetate, and at night a dose of Dover's powder (5–10 gr.—0.3–0.6 gm.), will usually suffice. If there be constipation, a few minute doses of calomel may be given with advantage; active purgation, however, should always be avoided.

In the more severe cases quinin, if well borne, may be given in small doses (2–5 gr.—0.13–0.3 gm.—thrice daily) throughout the attack. Rheumatoid pains are controlled to some extent by combinations of phenacetin with salicylates or benzoates. Only small doses, however, are admissible, and these should be carefully watched. The following is often useful:

℞ Acetphenetidini,
Salophen,
Sodii benzoatis, aa ʒj (4.0 gm.). M.
Fiant chartulæ No. xii.
Sig.—One every four hours.

When the suffering is intense, there need be no hesitation in administering morphin hypodermically. Violent headache is treated best by small doses of phenacetin and the application of an ice-cap to the head. Sulphonal and chloralamid are, perhaps, the most satisfactory drugs for combating troublesome insomnia. When the stomach is persistently irritable, the diet should be restricted to liquids, and all drugs, except those of a soothing character, withheld. Antiemetics, like bismuth subnitrate, hydrocyanic acid, cerium oxalate, and cocain, are indicated. A sinapism to the epigastrium may also be recommended.

In many cases of influenza cardiac weakness is a prominent feature. It demands the free use of alcoholic stimulants and of strychnin. The latter is especially well borne, and may be given, if necessary, in doses of $\frac{1}{30}$—$\frac{1}{20}$ of a gr. (0.002–0.003 gm.) every three or four hours. If more stimulation is required, aromatic spirits of ammonia and digitalis or strophanthus may also be given.

As the course of the disease is comparatively short, the fever, even when high, will rarely call for special medication. Antipyretic drugs in large doses are always inadmissible. Delirium is another symptom that may usually be ignored.

In the respiratory type expectorants are usually needed. When the cough is hard and dry, combinations of ipecac and potassium citrate, like the following, will be found useful:

℞ Potassii citratis, ʒij (8.0 gm.);
Syrupi ipecacuanhæ,
Tincturæ opii camphoratæ, aā fʒij (8.0 c.c.);
Succi limonis,
Glycerini, aā fʒss (15.0 c.c.);
Aquæ, q. s. ad fʒiij (90.0 c.c.). M.
Sig.—A dessertspoonful every two or three hours.

When expectoration is established, expectorants like ammonium chlorid, squills, and terpin hydrate may be substituted for ipecac and potassium citrate. Stupes or sinapisms to the chest are also useful in relieving cough. When pneumonia is threatened, dry cupping is often efficacious.

The convalescence should be most carefully watched, and strict injunctions given as to diet, rest, and the avoidance of exposure. Tonics are usually indicated and may be continued for several weeks. Change of air will materially help to restore strength and to overcome the peculiar mental depression.

## CROUPOUS PNEUMONIA.

Prophylaxis against croupous pneumonia consists largely in the avoidance of influences which tend to lower the resistance of the tissues. Undue exposure to cold and the excessive use of alcohol are important predisposing factors. Persons who have had one attack of pneumonia should be particularly attentive to their personal hygiene.

The sick-room should be well ventilated, but free from drafts. Indeed, the open-air treatment, as applied to tuberculosis, cannot be too strongly recommended. Fresh, pure air may be secured by screening off the bed and a portion of the room next to a window. This method of treatment may be adopted without regard to seasons or atmospheric conditions. The patient's sputum and all articles liable to be soiled with the sputum should be disinfected.

The diet should be fluid or semifluid. Milk, junket, wine-whey, broths, eggs, and gruel are suitable forms of nourishment. Cool water should be given freely.

**Specific Treatment.**—Croupous pneumonia cannot be aborted. Many methods of specific treatment have been recommended, but none has proved satisfactory. From the time of Laennec down to about the middle of the last century venesection was thought to be imperative. To-day, it is rarely practised except to meet certain indications.

In robust subjects, at the very onset, when the invasion is violent and attended with high fever, a bounding pulse, marked dyspnea, and severe pleuritic pain, the abstraction of from 10–20 oz. (300.0–600.0 c.c.) of blood may afford great relief. Later in the course of the disease, if cyanosis and orthopnea develop in consequence of overdistention of the right ventricle, venesection may also prove useful.

Tartar emetic, which at one time was thought to possess the power of aborting croupous pneumonia, has been entirely abandoned. The same fate has almost overtaken veratrum viride, although some clinicians still recommend it as a substitute for venesection.

The treatment of pneumonia by large doses of digitalis,—1–2 oz. (30.0–60.0 c.c.) of the tincture daily,—originally proposed by Petresco of Bucharest, has never had many advocates in this country. In 1894 Petresco reported 1192 cases treated by this method, with a mortality of 2.66 per cent. But the author himself states that the treatment is not applicable to very grave cases, and that his observations were made in a military hospital on young and robust men. Petresco's fig-

ures lose much of their significance when we compare them with the death-rate in the German army, which, according to Osler, was only 3.6 per cent. in 40,000 cases of pneumonia among healthy picked men.

Aufrecht ardently advocates the hypodermic administration of quinin,—8 gr. (0.5 gm.) once or twice a day,—not as an antipyretic, but as a specific, remedy. The mortality under this treatment in a series of 261 patients treated in the Altstadt Hospital at Magdeburg was 8.8 per cent., but we learn from Strusberg that in the medical clinic at Bonn during the same period the mortality under symptomatic treatment was only 7.97 per cent.

Carbonate of creosote (2–3 fl. dr.—8.0–11.0 c.c. daily) has recently been highly extolled as a specific by Van Zandt, Weber, and others. In the author's experience this drug has not hastened the crisis nor exerted any appreciable influence on the general toxemia.

Of all the special remedies recommended for pneumonia, antipneumococcic serum was the most promising. Perhaps sufficient time has not yet elapsed to warrant a final opinion upon its efficacy, but certainly those who have given it a fair trial will admit that it has fallen considerably below their expectations and has yielded results in no way comparable to those obtained in diphtheria from the use of antitoxin. In a fair test made by J. C. Wilson in the German Hospital, Philadelphia, the mortality under serum treatment in one series of 18 cases was 22.2 per cent., and in another series of 18 cases, 35.3 per cent.

Although we have yet no specific treatment, much may be done in the way of symptomatic treatment to avert a fatal issue. The indications, however, are extremely variable and must be carefully considered in each case. Routine treatment is to be rigidly avoided. In a large number of cases no drugs are needed. The symptoms that most often demand special attention are the pain, cardiac weakness, cough, fever, dyspnea, insomnia, and delirium.

**Pain.**—Morphin hypodermically is the best drug for subduing pleuritic pain. It also serves to overcome the restlessness and anxiety which often mark the onset of the disease, and which, if allowed to continue, tend to augment the exhaustion. Hot or cold applications to the chest are also useful. When the suffering is very severe, a few wet or dry cups to the affected side, followed by poultices, will be found efficacious.

**Cardiac Weakness.**—Alcohol is the best stimulant. When the pulse becomes compressible and dicrotic, and the diastolic sound at the pulmonary area loses its force, it should be given freely. Often 3 or 4 ounces (90.0–118.0 c.c.) of good whisky in the twenty-four hours will suffice, but in some instances two or three times this amount may be given with advantage. The patients who need it most are the old, the debilitated, and the alcoholic. Digitalis is undoubtedly useful in some cases, but its action is uncertain and often disappointing. In the author's experience it has been almost invariably badly borne when administered for the irregular flagging pulse of the period immediately following the crisis. Its frequent failure at other times may be explained by the fact that the cardiac insufficiency in the majority of cases is not dependent on simple dilatation or relaxation of the ventricles, but on degenerative changes in the myocardium, or perhaps, in some instances, on disturbances of the motor ganglia of the heart, brought about by the infection. Mechanical distention of the right ventricle undoubtedly does occur in some cases. It may be recognized by the enlargement of the area of cardiac dulness, by the marked cyanosis, the orthopnea, and the small pulse. In this condition digitalis, by driving the blood with great force against an impassable barrier, is likely to do harm; it is better to relieve the strain on the right ventricle by judicious venesection.

As a circulatory stimulant, strychnin generally proves much more efficacious than digitalis. It should be given in ascending doses of from $\frac{1}{60}$–$\frac{1}{15}$ of a gr. (0.001–0.0043 gm.), careful watch being kept for the appearance of untoward symptoms. In order that there may be immediate absorption, large doses should always be given hypodermically. Caffein is a useful adjuvant to strychnin, but it should not be used when there is cerebral excitement or insomnia. Wood speaks well of cocain —$\frac{1}{6}$–$\frac{1}{2}$ gr. (0.01–0.03 gm.)—alternately with strychnin, one or the other being given in grave cases every two hours. In threatening collapse the author has found no stimulant so generally serviceable as camphor. It is especially useful in tiding the patient over the profound depression that often accompanies or follows the crisis. It is available also when pulmonary edema arises as a complication, and in this condition it may be advantageously combined with atropin. To secure the best results, camphor should be given hypodermically, dissolved in ether or sterile olive oil, in doses of from 1–2 gr. (0.06–0.13 gm.) every two or three hours.

Subcutaneous injections of normal salt solution have also been useful in overcoming adynamia.

**Cough.**—For the hard, dry cough, especially of the fi stage, no remedy is so useful as opium in the form of Dove powder. Expectorants are rarely needed. The inflammato exudation in the air-vesicles is removed almost entirely absorption, and to attempt its expulsion by means of a dr is useless. When, however, there is a good deal of bronch catarrh, with much viscid sputum, ammonium carbonate m be given to facilitate expectoration, but it should be withdra immediately if it causes any disturbance of digestion.

**Fever.**—The fact that in a very large proportion of gravest cases the temperature is not high indicates that chief factor in bringing about the exhaustion is not the fe itself, but the toxemia. This being the case, and as the feb period is generally of a comparatively short duration, a pyretic measures may be restricted in the majority of case frequent cold sponging and the application of an ice-bag or ice-poultice to the affected side.

Persistent high temperature is best controlled by cool ba (80° F.—27.5° C.). Experience is strongly against the sy matic employment of antipyretic drugs, like phenacetin antipyrin.

**Dyspnea.**—Cardiac stimulants, since they favorably fluence the pulmonary circulation, are also of service in lieving dyspnea. Naturally, the circulatory stimulants are also respiratory stimulants, like strychnin, caffein, cocain, are the most useful. Oxygen makes the breath easier, lessens cyanosis, and conduces to sleep, and to extent aids in conserving energy.

**Insomnia and Delirium.**—When insomnia and delir are sufficiently severe to demand the use of drugs, mor will generally be found the most efficacious. Of cours should not be used when there is extreme dyspnea or w there are evidences of pulmonary edema. When the circ tory depression is not marked, chloral may be used. In o cases, chloralamid or sulphonal may be tried.

**Delayed resolution** is a troublesome complication. I tunately, it is of rare occurrence. It sometimes yields repeated blistering and the free use of tonics. Riess recommended injections of pilocarpin, and Dieulafoy, Forl and Lepine the production of aseptic abscesses by means turpentine injections. Edsall and Pemberton have rece reported three cases in which rapid improvement occu under the use of *x*-rays.

## DIPHTHERIA.

Diphtheria being a highly contagious disease, the utmost care should be taken to prevent the spread of the specific virus. General prophylactic measures include the isolation of the sick, absolute cleanliness in the sick-room, and the thorough disinfection of all articles of clothing and fomites that may have become contaminated with the secretions from the infected area. As diphtheria bacilli often remain in the throat for weeks or even months after the disappearance of the false membrane, isolation should be urged until the bacilli can no longer be detected in the throat by bacteriologic examination.

Physicians and nurses, in applying local remedies, must be exceedingly careful lest they become infected directly by shreds of false membrane expelled by the patient in coughing.

Finally, exposed persons, especially children, should receive an immunizing dose of diphtheria antitoxin (see p. 431).

The sick-room should be well ventilated, and the temperature maintained at about 70° F. (21° C.). It is desirable to have the atmosphere moist, and this may be accomplished by generating steam in an ordinary kettle or in a steam atomizer, or by slaking large quantities of quicklime in the room. Young children, especially when laryngeal symptoms are present, are best treated in a steam-moistened tent. Absolute rest must be enforced. The diet should be of the most nutritious and easily digested character. Milk, junket, ice-cream, eggs, and unseasoned broths may be allowed. After tracheotomy it may be necessary, in order to introduce sufficient nourishment, to feed through a soft-rubber nasal tube. Cool water should be given freely. The medicinal treatment of diphtheria is both local and constitutional.

**Local Treatment.**—Local treatment is of great importance, but often difficult to carry out. When the applications cause violent struggling and exhaust the child, it may be better to desist. Applications should be made with utmost gentleness, should be unirritating, and should be frequently repeated. Remedies may be applied by means of absorbent cotton on a swab, or by sprays, injections, or irrigations. In pharyngeal diphtheria the first method is usually the best, while in nasal diphtheria the employment of a syringe or irrigator is preferable. The nozzle of the instrument should be blunt and covered with soft rubber, and the nurse should be instructed to introduce it gently and in a horizontal direction. In both nasal and pharyngeal diphtheria, when the child cannot be raised, the fluid may be poured into the nose from a spoon, minim-dropper, or, better, from a nasal cup (Jacobi). Sprays are not

very efficacious. In laryngeal diphtheria local treatment is rarely feasible, except by means of medicated vapors.

Many local remedies have been recommended; the following are, perhaps, the most generally useful: Solution of hydrogen dioxid (1 : 2 of lime-water), Löffler's solution (see p. 293), or corrosive sublimate (1 : 5000 to 1 : 1000). All applications to the nasal mucous membrane should be warm. False membrane should never be torn off, but when it is very loose, it may be carefully dislodged and removed. Emetics are sometimes useful in expelling false membrane from the larynx, but when there are marked symptoms of obstructive dyspnea, the operation of intubation or tracheotomy should not be deferred.

Externally, hot or cold applications, whichever may be more grateful to the patient, are useful in relieving pain and soreness in the throat. When there is marked swelling of the cervical glands, an ointment of mercury and belladonna is sometimes of service.

**Constitutional Treatment.**—Statistical reports from all parts of the world prove conclusively that the remedy of greatest value in the treatment of diphtheria is the blood-serum of animals rendered artificially immune against the disease (see article on Diphtheria Antitoxin, p. 431). Apart from antitoxin, the most important remedies are those which tend to maintain the bodily strength. Alcoholic stimulants are usually indicated, especially in the late stage of the disease. In septic cases alcohol is particularly well borne, a child of three years often being able to take several ounces of whisky a day with advantage. Next to alcohol, strychnin is the best stimulant. In profound adynamia, digitalis, caffein, camphor, and musk are also useful.

Two drugs which are believed to be of special value, but which have lost some of their reputation since the introduction of antitoxin, are the tincture of the chlorid of iron and mercury. From 3–5 min. (0.2–0.3 c.c.) of the tincture of ferric chlorid may be given in glycerin or water every two or three hours to a child of four years. It should, however, be suspended on the first appearance of digestive disturbance. Children with diphtheria are usually very tolerant of mercury, and as much as $\frac{1}{40}$ of a grain (0.0016 gm.) of corrosive sublimate may be given every three hours to a child of three or four years.

Potassium chlorate is another popular remedy. Its action, however, is a purely local one. On account of its irritant effects on the kidneys it should never be used internally. Convalescence must be managed with special care, on account

of the tendency to cardiac weakness. Anemia, a common sequel, will require good hygienic surroundings, plenty of nourishing food, and iron. Diphtheric paralysis usually yields to strychnin and other tonics, combined with the use of massage and electricity.

## SCARLET FEVER.

To prevent the spread of the disease, the patient should be rigidly isolated. The sick-room should be large and airy, and, if possible, it should be at the top of the house. All unnecessary furniture should be removed from the room, and no one should be allowed to enter it except the physician and nurse. The nurse should wear a loose wrapper and cap, to be left inside the room when she is obliged to leave it. All articles that have been in contact with the patient should be thoroughly disinfected before they are permitted to be taken from the room. Finally, to prevent the dissemination of the scales, some bland ointment (cold cream, olive oil, cocoa-butter) should be applied to the patient's body at least once a day until desquamation is complete. During the period of active desquamation the inunctions should be preceded by warm alkaline baths.

The treatment of scarlet fever is purely symptomatic. The patient should be kept in bed until the end of desquamation. The diet should consist of milk, junket, koumiss, ice-cream, fruit-juices, and gruels. So as not unnecessarily to tax the kidneys, animal broths and meat should be withheld, if possible, until convalescence is well established. Water should be given freely to relieve thirst and to keep the secretions active.

In many cases no special medication is required beyond the use of a mild refrigerant mixture, such as the following:

℞ Spiritus ætheris nitrosi, f℥vj (22.5 c.c.);
Liquor ammonii acetatis, q. s. ad f℥iij (90.0 c.c.). M.
Sig.—Dessertspoonful with water every three hours for a child of five years.

**Vomiting.**—When vomiting is severe, it may be necessary to withhold food for several hours and to administer an antiemetic, such as ice, carbonated water, bismuth subnitrate with hydrocyanic acid, or cocain ($\frac{1}{20}$–$\frac{1}{10}$ gr.—0.003–0.006 gm.). In very obstinate vomiting opium suppositories or chloral enemata should be tried.

**Fever.**—Tepid sponging is very grateful throughout the febrile period. Fever above 103° F. (39.5° C.) should be combated with cold packs or gradually cooled baths (80° F.—

26.5° C.), and by cold applications to the head. Phenacet antipyrin, and other antipyretic drugs should not be us except as a last resort, and then only in small doses.

**Cardiac Weakness.**—If the heart shows signs of faili alcoholic stimulants will be demanded. Many practition believe that the tincture of ferric chlorid (1 drop a dose each year of the child's age) exerts a favorite influence u the general toxemia. Threatened collapse will require the of such remedies as strychnin, digitalis, camphor, ammo and musk.

**Nervous Symptoms.**—Restlessness, jactitation, he ache, and insomnia will generally yield to small doses c bromid and to the application of cold to the head. W these symptoms are severe, however, no remedy is so us as chloral. It may be given in doses of from 3–5 gr (0.2–0.3 gm.) every three or four hours. Nervous sympt the result of high fever will, of course, require vigorous a pyretic treatment.

**Throat Symptoms.**—Cleansing of the nose and th with mild antiseptic sprays or washes will do much to pre the development of septic adenitis and middle-ear dis Weak Dobell's solution or solution of hydrogen dioxid (1 may be used for this purpose. When tonsillitis is severe following application will be found useful:

℞ Potassii chloratis, gr. xx (1.3 gm.);
Tincturæ ferri chloridi,
Glycerini, aa f℥ss (15.0 c.c.);
Aquæ, q. s. ad f℥ij (60.0 c.c.). M.
Sig.—Apply to the tonsils several times a day with a cotton s

Pain and swelling in the neck are best relieved by ice p tices; in some cases, however, hot compresses are more g ful. When suppuration occurs, the abscess should be f opened and dressed antiseptically.

In **acute otitis media** nothing affords so much rel gently syringing the auditory canal with hot water. application of a leech behind the ear is also useful. W the tympanic membrane bulges, indicating the presenc pent-up pus, the latter should be evacuated by puncture.

**Nephritis.**—A milk diet, tepid bathing during the f period, and the avoidance of exposure for several weeks the subsidence of the fever are important prophylactic m ures against nephritis. Should this complication dev however, dry cupping over the loins, followed by warm fo tations, will often prove of value. Aperients, especially sa

are indicated. Warm baths, hot packs, vapor baths, or pilocarpin ($\frac{1}{16}$—$\frac{1}{10}$ gr.—0.004–0.006 gm.) should be used to promote diaphoresis. When the urine is scanty, unirritating diuretics, like potassium acetate or bitartrate and digitalis, are of service.

## MEASLES AND RUBELLA.

The prophylactic measures described in connection with scarlatina are applicable in measles and rubella.

Measles is a self-limited disease and cannot be aborted. The temperature of the sick-room should be maintained at about 68° F. (20° C.). The patient should be kept in bed until all traces of the rash have disappeared, and confined to his room for a week or ten days longer. On account of the photophobia the room should be moderately darkened, and the bed so arranged that the face will be directed away from the light. When the cough is troublesome, the atmosphere should be kept moist.

Milk, junket, fruit-juices, broths, eggs, and gruels are suitable forms of nourishment. Water should be proffered at frequent intervals. Stimulants are rarely required except in malignant cases.

Daily inunctions of the body with cold cream or olive oil will serve to allay burning and itching of the skin. Spraying the nose and throat at frequent intervals with warm Dobell's solution will aid in preventing buccal and aural complications. When conjunctivitis is marked, the eyes should be protected with dark glasses and frequently cleansed with a solution of boric acid (15 gr. to the oz.—1.0 gm. to 30.0 c.c.). Hot baths and hot drinks are indicated when the rash is delayed.

Fever, unless persistently high, may be left alone. When antipyretic measures are required, tepid sponging or immersion for a few minutes in water gradually cooled from 95° F. (35° C.) to 80° F. (26.5° C.) will be found the most satisfactory. Antipyretic drugs should be used only as a last resort.

The **medicinal treatment** of measles is usually very simple. Constipation should be relieved by small doses of calomel or by glycerin suppositories. Severe vomiting may require cracked ice, lime-water, bismuth subnitrate, cocain, or suppositories of opium. Diarrhea will generally yield to a few doses of bismuth subnitrate and opium. Troublesome headache and insomnia are best treated by bromids or small doses of chloral.

Cough very frequently requires attention. The application of sinapisms to the chest, the inhalation of steam, and the

administration of sedative expectorants with opium are meas
ures calculated to afford relief. The following mixture will b
found useful:

℞ Potassii citratis, ℥ij (8.0 gm.);
Vini ipecacuanhæ, f℥ij (8.0 c.c.);
Tincturæ opii camphoratæ, f℥iij (11.0 c.c.);
Syrupi tolutani, f℥j (30.0 c.c.);
Aquæ cinnamomi, q. s. ad f℥iij (90.0 c.c.). M.
Sig.—A teaspoonful every three or four hours.

A mixture of ammonium chlorid and syrup of squill will h
efficacious when the cough loosens.

The treatment of **rubella** does not differ materially fro
that of measles.

## SMALLPOX.

The preventive measures against smallpox include the cor
plete isolation of the patient (preferably in a special hospita
the thorough disinfection of all objects that have been in co
tact with him, and, above all, the vaccination of all who ha
been or who are likely to be exposed to the contagion.

**Vaccination.**—Vaccination does not afford complete a
permanent immunity against smallpox, but in the vast major
of cases it renders the person insusceptible to the disease fo
number of years. In Prussia the death-rate from smallp
per 100,000 of population prior to the enforcement of gene
vaccination (1846–74) was 24.4, while after the enforceme
of general vaccination (1874–86) it was only 1.5 (Abbo
In the hospitals of London, from 1876–79, there were admitt
11,412 smallpox patients who had been vaccinated in infan
but not a single case was known to have occurred in a pers
who had been successfully revaccinated (Welch).

Vaccination should be performed at the third month (earl
if smallpox be epidemic), again at puberty, and subsequen
whenever smallpox is prevalent. Only bovine lymph shou
be used, and preference should be given to that which h
been glycerinated and preserved in hermetically sealed gl
tubes. The part selected should be thoroughly cleansed, fi
with soap and water, then with alcohol, and finally with pu
water. Many methods of performing the operation are reco
mended. The simplest is to make, with a sterile lancet
special scarificator, a number of cross scratches, only de
enough to allow of a little oozing of pinkish serum. The wi
drawal of blood is to be carefully avoided, as it tends to wa
away the vaccine material. The virus is now applied and w
rubbed into the exposed lymphatic spaces by additional sca

fication. A shield may be worn for a few hours, until the wound has become perfectly dry; after that it should be discarded, since it serves, especially if tight-fitting, to intensify the inflammatory reaction.

For a vaccination to be considered successful the vaccine lesion should pass through a papular, vesicular, and pustular stage, and leave behind a permanent cicatrix. A typical vesicle resembles "a section of a pearl on a rose leaf" (Jenner). A good scar is pale, sharply defined, and pitted.

**General Management.**—There is no specific for smallpox. Absolute rest in bed, light bed-clothing, a well-ventilated room of a temperature of 65° F. (18.5° C.), an easily assimilable but sustaining diet, and the free use of cool drinks are requisites of treatment. The severe lumbar pains will require opium and the application of hot-water or hot-bran bags. Fever above 103° F. (40° C.) is best combated by hydrotherapy—cold sponging, cold packs, or cold baths. Antipyretic drugs should be used with great caution.

Gastric irritability may be controlled by dilute hydrocyanic acid (2 min.—0.1 c.c.), subnitrate of bismuth (10 gr.—0.6 gm.), or cocain ($\frac{1}{8}$ gr.—0.008 gm.). Diarrhea should be remedied by the use of bismuth and morphin powders (see p. 375). When nervous symptoms—jactitation, delirium, and insomnia—are not relieved by hydrotherapy, opium with bromids or chloral with bromids should be tried. Alcoholic stimulants are frequently demanded, especially in confluent cases. Quinin is also useful in the adynamia of sepsis.

An attempt should be made to keep the nasopharynx clean by means of antiseptic sprays or douches. For this purpose Dobell's solution or solution of hydrogen dioxid (1 : 4) will be found useful. The eyes should also be kept clean by frequent applications of a warm boric-acid solution (15 gr. to the ounce—1.0 gm. to 30.0 c.c.).

**The Eruption.**—Cool antiseptic washes, such as carbolic, 1 : 200, or corrosive sublimate, 1 : 5000–1 : 10,000, are, perhaps, the most useful applications that can be made to the skin. Compresses wet with these solutions may be kept constantly on the face and hands to exclude the light, which, there is some reason to believe, acts unfavorably on the pocks. Many remedies have been recommended to prevent pitting, but it is doubtful whether any are really efficacious. An old plan was to open the vesicles and touch their base with a stick of silver nitrate. Dujardin-Beaumetz recommended an ointment of sodium salicylate (4 parts) and cold cream (100 parts). Hebra speaks favorably of continuous warm baths. Finsen, Feilberg,

and others recommend the exclusion of the chemical rays of light from the sick-room, red light only being admitted; but this plan of treatment does not appear to be particularly beneficial, and has the drawback of putting a check on the supply of fresh air.

In the stage of desiccation, warm baths followed by inunctions with cold cream or olive oil are useful in allaying itching and in hastening the removal of the crusts.

## YELLOW FEVER.

In the absence of any specific remedy, the treatment of yellow fever must be mainly expectant. Absolute rest and quiet, a sick-room well ventilated but free from drafts, and careful nursing are essential. The patient should be isolated and protected by nets and wire screens from mosquitoes. Only the blandest articles of food should be allowed, and these should be given in small quantities. Peptonized milk, milk with lime-water, junket, koumiss, milk-punch, barley-water, toast-water, and iced champagne are available. Carbonated waters like Vichy and Apollinaris, are grateful and useful. Sternberg, Touatre, and many other clinicians of wide experience in the treatment of the disease advocate the withholding of all food during the first two or three days.

If the patient be seen in the first twenty-four hours of the illness, a hot mustard foot-bath may be given with advantage. If there be a tendency toward constipation, a few small doses of calomel may be administered and followed by a Seidlitz powder, or a purgative enema may be used.

It is very questionable whether any drug has the power of modifying the course of the disease as a whole, although Sternberg is firmly convinced of the efficacy of the following combination:

℞ Sodii bicarbonatis, ʒiv (15.0 gm.);
Hydrargyri chloridi corrosivi, gr. ss (0.03 gm.);
Aquæ destillatæ, Oj (475.0 c.c.). M.

Sig.—In severe cases, two teaspoonfuls every hour, day and night; in mild cases, every hour by day and every two hours by night; administer ice-cold.

**Obstinate vomiting** should be combated by the application of an ice-bag or a sinapism to the epigastrium and by the administration of sedatives, like cracked ice, lime-water, hydrocyanic acid, or cocain. In severe cases it is best to let the stomach have complete rest and to give morphin hypodermically or by the bowel.

Systematic cold sponging keeps down the temperature, lessens nervous excitability, and favors diuresis.

**High temperature** should be controlled by the cold bath.

**Suppression of urine** will call for dry cupping over the loins, alkaline diuretics, hot-air or hot-water baths, and, perhaps, rectal or subcutaneous injections of warm saline solutions (see pp. 488–498).

If there are signs of **heart-failure,** alcoholic stimulants should be given freely: iced champagne and iced brandy with soda water are the remedies most favored. Threatened collapse will require subcutaneous injections of strychnin, ether, or camphor, hot baths, and enemata of black coffee or brandy.

Remedies have little, if any, control over **black vomit.** Guiteras recommends tincture of ferric chlorid, and Carroll, oil of turpentine.

## CHOLERA.

Hygienic measures are of the utmost importance in preventing the spread of cholera. Personal prophylactic measures against the disease include removal from the infected districts; restriction of the diet to bland, easily digested food; thorough sterilization of drinking-water and milk; the protection of all food from contamination by flies and other insects; the avoidance of overwork, exposure to wet and cold, and undue excitement; and the prompt treatment of any gastro-intestinal disturbance that may arise. Certain acids, especially sulphuric acid, have long been advocated as preventives of cholera. Finally, vaccination with attenuated cholera cultures, as practised by Haffkine in India, has given encouraging results.

Precautionary measures pertaining to the sick comprise isolation, absolute cleanliness, and the thorough disinfection of excreta, soiled clothing, etc.

The medicinal treatment of cholera resolves itself into that of the prodromal stage, that of the algid stage, and that of the reaction stage.

**Prodromal Stage.**—From the first appearance of diarrhea the patient should go to bed and remain there. Food should usually be withheld. If there be a history of indigestible food having been taken, a laxative dose of calomel or of castor-oil should be given; otherwise, aperients should be avoided. Hot stupes may be applied to the abdomen. If there be much colic, morphin may be given hypodermically. In the last European epidemic (1892) many good observers reported adversely upon the use of opium by the mouth. For the diarrhea, bismuth subnitrate is perhaps the best astringent.

**Algid Stage.**—Intravenous injections of warm saline solutions (see p. 496) undoubtedly afford the best means of combating the anhydremia and of restoring the failing circulation. Rectal injections of hot tannic solutions (2 per cent.), as strongly recommended by Cantani, may also be used. The body-temperature should be maintained by hot applications or hot baths. Diffusible stimulants, like ether and camphor, may be given hypodermically.

To allay thirst, ice, ice-water, or iced Seltzer water may be given at frequent intervals. The painful cramps are best treated by warm applications, hot baths, gentle friction with anodyne liniments, and, above all, by intermittent chloroform inhalations. In suppression of urine the most promising measures are dry cupping over the loins, and rectal and intravenous injections of saline solutions.

**Reaction Stage.**—In this stage liquid foods in small quantities are permissible. Milk with lime-water, whey, thin gruels, albumin-water, and light broths are the most appropriate. The return to ordinary food should be effected most gradually. Water should be given freely, since it tends to restore vascular fulness and favors diuresis. Any tendency to recurrent diarrhea should be met by the administration of bismuth subnitrate with an intestinal antiseptic or of silver and opium pills. Bitter tonics are often of service during convalescence. Change of air is a valuable aid to the restoration of health.

## WHOOPING-COUGH.

The chief elements in the prophylaxis of whooping-cough are isolation of the patient and the thorough disinfection of all articles that have been used by him. Quarantine should last until the cough ceases, which will seldom be before the end of six or eight weeks from the onset of the disease.

As there is no specific, treatment must be directed to relieving the catarrh, allaying the irritability of the respiratory mucous membrane, and warding off complications. Fresh air, sunlight, protection from changes of weather, and a light but nutritious diet are essential. In some cases it may be desirable to keep the patient in his room, or even in bed, for the first few days, but ordinarily, if the weather be good, he need not be confined indoors. In advanced cases sea air often acts most favorably. In some instances, when the vomiting is very persistent, it may be desirable to withhold food by the mouth for a short period and to substitute nutritive enemata.

Expectorants are rarely of service except in the first stage

when the cough lacks the distinctive whoop and is hard and dry. At this period a mixture of potassium citrate, ipecac, and paregoric (see p. 528) may be useful in rendering the expectoration less viscid.

**Special Remedies.**—Of the numerous special remedies advocated, the chief are belladonna, quinin, bromids, antipyrin, bromoform, and alum. No one drug is of service in every case, and after failing with one, another should be tried. Belladonna has a long-established reputation; to be effective, it must be given in ascending doses until a constitutional impression is perceptible (see p. 80). Quinin, first recommended by Letzerich, is undoubtedly of value in many cases; it must be given, however, in large doses,—10–12 gr. (0.65–0.8 gm.) a day for a child of three or four years,—and these may disturb digestion. The bromids, especially of sodium and strontium, are often of service in lessening the frequency and severity of the paroxysms. They may often be advantageously combined with belladonna. Antipyrin has been advocated since 1886, and is, on the whole, perhaps, the most reliable remedy. The dose should be gradually increased until a child one year old receives from ½–1 gr. (0.03–0.06 gm.) every two hours. It is particularly efficacious in combination with a bromid, as in the following formula:

℞ Sodii bromidi, gr. l (3.2 gm.);
Antipyrinæ, gr. xv (1.0 gm.);
Glycerini, ʒss (15.0 c.c.);
Aquæ menthæ piperitæ, q. s. ad ʒiij (90.0 c.c.). M.
Sig.—A teaspoonful every two hours for a child one year old.

Bromoform, introduced by Stepp in 1887, has been warmly recommended by Fischer, Burton-Fanning, and others. The initial dose for a child under two years of age should not exceed 1 min. (0.06 c.c.) four times a day (see p. 117).

Alum is a very old remedy; in small doses—1 gr. (0.06 gm.) every two hours for a child of one year—it is occasionally useful when there is copious secretion.

Chloral (3 gr.—0.2 gm.—for a child of two years) or Dover's powder (1 gr.—0.06 gm.) may be given in severe cases at bedtime to secure sleep. The inhalation of chloroform or of amyl nitrite may be necessary when the paroxysms are so violent as to threaten hemorrhage or convulsions.

For the prevention of excessive vomiting, Kilmer highly recommends the application of an abdominal belt made of linen, with a strip of elastic webbing two inches wide, inserted on each side. The belt extends from the axillæ to the pubes and laces in the back.

**Local Treatment.**—Mild but persistent counterirritation over the chest is sometimes useful, particularly when the catarrhal element is prominent. Medicated steam inhalations with eucalyptol, benzoin, creasote, or terebene are also very beneficial when there is excessive bronchitis or a pneumonic complication. Good effects have been claimed for oxygen and ozone inhalations. Antiseptic and sedative sprays, when feasible, sometimes afford much relief; the best are the solution of hydrogen dioxid (1 part to 6 parts of water), menthol (5–10 per cent. in liquid paraffin), resorcin (1 per cent. aqueous solution). Insufflations of drugs in the form of a fine powder—quinin, boric acid, tannin, benzoin, etc.—have been warmly advocated by many, but they are of doubtful benefit.

**Convalescence.**—During convalescence it is necessary to exercise considerable care, on account of the great danger of catarrhal pneumonia. Tonics, especially quinin, iron, and cod liver oil, are very useful. When there is persistent enlargement of the bronchial glands, iodid of iron internally, with inunctions of europhen (5 per cent.), will be found efficacious. Change of air is always beneficial.

## ERYSIPELAS.

As in other contagious diseases, isolation and disinfection are the most important prophylactic measures. Especially necessary is it to guard parturient and surgical patients from the contagion.

**Internal Treatment.**—A supporting liquid diet should be given. Alcoholic stimulants are sometimes required in considerable quantities. High fever is best controlled by cold sponging or the cold pack. Restlessness, delirium, and insomnia will call for applications of ice to the head, and perhaps the administration of morphin, chloral, or bromids.

Of the numerous special remedies recommended for erysipelas, the one which has enjoyed the most favor is the tincture of ferric chlorid (20–30 min.—1.2–2.0 c.c.—every three hours), first suggested by Bell in 1851. While apparently of some service, this drug is not a specific, and should be withdrawn if it disturbs digestion. The therapeutic status of antistreptococcus serum has not yet been definitely determined, although it has been frequently administered in severe cases with alleged good results.

**Local Treatment.**—Among the numerous local applications recommended for erysipelas may be mentioned mixtures of zinc oxid, boric acid, and starch on cotton-wool; lotions o

lead-water and laudanum, of carbolic acid (1 : 40), of corrosive sublimate (1 : 5000), of picric acid (1 : 100), and of magnesium sulphate (saturated aqueous solution on a mask of from 15 to 20 thicknesses of gauze); and ointments of ichthyol (30 per cent.) and of soluble silver (15 per cent.). In the author's hand, ichthyol (see p. 335) and soluble silver (see p. 374) have proved the most satisfactory local remedies.

Eschars made with the stick of silver nitrate or strong carbolic acid beyond the infected area are occasionally successful in arresting the spread of the disease. The cellular infiltration caused by these irritants probably serves to check the migration of the cocci. The injection of antiseptics, such as carbolic acid and corrosive sublimate, around the diseased area is of very doubtful utility.

Local abscesses should be incised and treated antiseptically. Extension to the nose and throat will call for antiseptic sprays or washes. Should the larynx become involved, the constant sucking of ice may serve to control the swelling; whenever, however, dyspnea becomes urgent, scarification of the larynx or tracheotomy will be demanded.

## TETANUS.

The most important safeguard against the occurrence of tetanus is the thorough cleansing and disinfection of all wounds. As tetanus antitoxin is practically harmless and has been shown to possess considerable immunizing power, it is advisable to employ it as a prophylactic remedy in all suspicious wounds, especially those which have become contaminated with garden earth, street dirt, or stable refuse.

When tetanus has actually developed, the indications for treatment are to prevent the further production of toxin at the seat of injury; to neutralize the toxin that has already been absorbed and is exerting a baneful influence on the nervous system; to subdue the convulsions; and to maintain nutrition until the disease shall have run its course.

The first indication is to be met by promptly enlarging the wound, freeing it from all foreign matter, and treating it with some active antiseptic. The most hopeful means of meeting the second indication is by administering tetanus antitoxin (see p. 432). Of 290 cases of tetanus treated by the subcutaneous injection of serum, death occurred in 117 (Moschowitz).[1] While an analysis of the statistics does not justify the conclusion that antitoxin is very potent in acute cases, it does suggest that the

[1] *Medical News*, October 13, 1900.

remedy is of distinct value in subacute and chronic tetanus. As no ill effects result from the administration of the serum, and as its use does not interfere in any way with other methods of treatment, we believe that it should be used in large doses in every case, and as soon as possible after the onset of the symptoms. When the symptoms are grave it would seem to be advisable to inject the serum directly into the brain or into the subarachnoid space of the spinal cord. Forty-eight cases treated by cerebral injections presented a little over 50 per cent. of recoveries. All these cases, however, were of the severest type (Moschowitz). According to von Leyden, of 11 severe cases treated by subarachnoid injections, recovery occurred in the last 5.

Bacelli has reported excellent results (1 death in 40 cases) in the treatment of tetanus from the subcutaneous administration of carbolic acid in large doses (see p. 389), but other observers outside of Italy have not been able to repeat his success. It is not improbable that tetanus runs a milder course in Italy (Pfeiffer). As the central nervous system seems to possess some antitoxic power, the injection of brain-substance subcutaneously has been recommended.

The drugs most effective in subduing convulsions are the bromids and chloral. These should be given in large doses. Morphin and eserin are useful adjuvants. Subarachnoid injections of magnesium sulphate (see p. 217) have yielded satisfactory results in a few cases. Inhalations of chloroform or of amyl nitrite sometimes afford temporary relief. Of course the patient should be kept absolutely quiet and protected from cold and from even the slightest external irritation.

The maintenance of nutrition by the administration of nutriment in liberal quantities is of the utmost importance. In severe cases, milk, raw eggs, and animal broths are suitable forms of nourishment. Alcohol is often necessary, sometimes in large quantities. When swallowing is impossible, feeding must be carried out by means of a tube passed through the nostril.

## RHEUMATIC FEVER.

**General Management.**—Absolute rest in a comfortable bed is essential, and, with the view of preventing permanent injury to the heart, this should be maintained for at least ten days or two weeks after the temperature has become normal and all the arthritic symptoms have subsided. To guard against chilling of the body, the patient should wear a loose

flannel night-dress and lie between blankets. The room should be well ventilated, but free from draft. Milk and cereals are the most suitable articles of diet. Junket, koumiss, ice-cream, milk-toast, boiled rice, and gruels may be given. During the febrile period animal food is best avoided. During convalescence, however, fish, oysters, eggs, and broths are admissible. The free use of water and of lemonade should be encouraged. Alcohol, unless the heart is seriously involved, is not often required.

**Internal Treatment.**—Salicylic compounds have considerable power in mitigating pain, shortening the duration of the attack, and of lessening the liability to cardiac complications. The more typical the case, the more decided are the good effects of these drugs. From 10 to 15 gr. (0.65–1.0 gm.) of ammonium or sodium salicylate should be given every two or three hours, until a decided impression is made upon the disease or the phenomena of salicylism are produced, when the interval between the doses should be lengthened to four or six hours. It is advisable to continue the drug for several days after the subsidence of the symptoms. When the ammonium or sodium salt is not well borne, strontium salicylate (see p. 399) or aspirin may be substituted.

Alkalis are also remedies of value; they may be combined with the salicylates or they may be given alone. About 20 gr. (1.3 gm.) of potassium citrate or acetate should be given every two or three hours until the urine becomes decidedly alkaline; then every four or six hours, the influence of the remedy being maintained for at least a week after all symptoms have disappeared.

Opium, in the form of Dover's powder or of morphin hypodermically, is sometimes of great value in allaying pain, subduing restlessness, and procuring sleep. Antipyrin or phenacetin, in moderate doses, is also a useful adjuvant to salicylates or alkalis when the pain is severe. When adynamia is marked, quinin (5 gr.—0.3 gm.—thrice daily), as recommended by Garrod, Duckworth, and DaCosta, is frequently beneficial. Anemic patients are usually benefited by iron. A useful combination is the ferrosalicylate mixture recommended by S. S. Cohen:

℞ Sodii salicylatis, ʒiij (12.0 gm.);
Glycerini, fʒv (22.5 c.c.);
Mucilaginis acaciæ, fʒiij (12.0 c.c.);
Olei gaultheriæ, ♏xij (0.8 c.c.);
Liquoris ammonii citratis (B. P.), fʒiss (45.0 c.c.);
Solve et adde guttatim,
Tincturæ ferri chloridi, fʒiij (12.0 c.c.). M.
Sig.—One to two teaspoonfuls in water every three hours.

In some cases, when the usual remedies prove unsatisfacto syrup of iodid of iron, in large doses (1–3 fl. dr.—4.0–11.0 c —daily), as recommended by J. C. Wilson, is quite effectual

Hyperpyrexia is best controlled by the cold bath (see 493). The treatment of endocarditis and of pericarditis w be treated in another part of this volume. The importance prolonged rest in cases in which the heart becomes affec cannot be overestimated. During convalescence, tonics, l iron, quinin, and arsenic, and a liberal diet are necessary.

**Local Treatment.**—In mild cases the application of c ton-wool to the affected joints will suffice. When the pai severe, hot alkaline lotions sometimes afford relief; but, a rule, compresses soaked in methyl salicylate and covered w oiled paper are much more effective. Ointments contain salicylic acid (see p. 398) are also useful. In some cases sn blisters applied about the inflamed joints are of great util According to Osler, however, they are not nearly so benefi as light applications of the thermocautery.

No matter what local remedy is selected, it is very imp tant that the affected joints should be kept at complete r This may be accomplished by means of padded splints ar roller bandage or, often better, by the use of starch banda or plaster casts.

Lingering swelling will often yield to an ointment of m cury and belladonna, with firm strapping of the articula Blisters are also useful. When the effusion is very great persistent, it may be necessary to aspirate the joint.

For the stiffness of the joints induced by rheumatism, m sage, warm baths, and inunctions with an ointment of i will be found useful. The hot-air treatment (see p. 485) does good in some cases.

## MUMPS.

In the majority of cases but little treatment is required. patient should be confined to a warm room and preferabl bed. Isolation should last about three weeks from the o of the disease. As deglutition is painful, the nourishment n be fluid. A mild aperient may be administered at the ou If febrile symptoms are marked, refrigerants, like aconite, s of nitrous ether, and solution of ammonium acetate will found useful (for formula, see p. 63). Pain in the throa best relieved by sucking ice.

**Local Treatment.**—In mild cases, covering the gl with cotton batting will be all that is necessary. When t

is decided pain, hot fomentations proove soothing. Emollient applications with laudanum (1 fl. dr. to 1 oz.—4.0 c.c. to 30.0 gm.) are frequently recommended. An ointment of guaiacol (5 per cent.) has recently been warmly advocated.

Orchitis will require rest, suspension of the affected gland, and the application of lead-water and laudanum or, better still, of an ointment of guaiacol (10 per cent.). After the tenderness has subsided, an ointment of mercury and belladonna will be found useful in reducing the swelling.

## CONSTITUTIONAL DISEASES.

### DIABETES MELLITUS.

The treatment of diabetes mellitus is dietetic, hygienic, and medicinal.

**Dietetic Treatment.**—The general rule is to eliminate from the dietary, at least for a time, all starchy and saccharin foods. Some relaxation of this rigid rule, however, is often desirable and even necessary. Each case must be carefully studied from the standpoint of the urine, the body-weight, and the general health. In mild types of the disease, after the glycosuria has once been controlled by strict dietetic regimen, it is generally possible to add a certain amount of carbohydrate matter without causing the reappearance of sugar in the urine. The exact amount and character of the carbohydrates that can be tolerated should be determined in each instance by frequent quantitative estimations of the sugar excreted. Again, in severe cases it is frequently necessary, in spite of some increase of glycosuria, to permit greater latitude in diet, in order to sustain the patient's strength. "There can be no doubt that a diabetic patient whose strength is well maintained is better off than one whose urine contains only 1 per cent. of sugar, but yet is daily growing weaker" (Strümpell).

The strict diet precludes the use of the following articles: bread, cakes, and pastry made of wheat, rye, rice, or corn, sago, barley, tapioca, beets, carrots, turnips, parsnips, peas, sweet fruits, chestnuts, chocolate, syrup, preserves, sweet wines, malt liquors, cordials, and all preparations containing cane-sugar or glucose.

Potatoes are generally classed among the forbidden articles, but Mossé and Saundby have shown that they are not only permissible in many cases, but even useful. Mossé advances two hypotheses to explain the beneficial action of potatoes; the first is that they yield a sugar more easily warehoused

than that from bread; and second, that they introduce a s
stance (potash) into the organism which favors glycoly
The following articles may be allowed:

*Animal Food.*—Meats of various kinds (except liver), ga
light broths and soups, fish, and eggs. Fats, when well diges
are beneficial and may be taken freely.

*Vegetables.*—Spinach, cabbage, Brussels sprouts, cauliflo
celery, lettuce, water-cress, string-beans, young onions, to
toes, mushrooms, asparagus tips, cucumbers, and dandel

*Bread.*—In very many cases a small amount (2 or 3 ou
a day) of bran bread or whole-wheat bread may be permit
Gluten bread is also used, but most so-called gluten fl
contain a large percentage of starch. Many substitutes
been recommended for wheat bread, but even the best of t
are rather unpalatable and heavy. The best known are b
or biscuit made of pure bran (Prout), of almond meal (Pa
of inulin (Külz), of Soya bean (Dujardin-Beaumetz), and
aleuronat, a glutinous flour obtained as a by-product in
manufacture of starch (Ebstein, von Noorden).

*Beverages.*—Buttermilk, skimmed milk, carbonated wa
mineral waters (Vichy, Carlsbad, Vals, and Saratoga), tea
coffee without sugar, and alcoholic beverages containing
or no sugar (claret, Rhine wines, dry Moselle, Bordeaux,
sherry, well diluted brandy or whisky). No restriction sh
be placed on the amount of water desired.

*Relishes.*—Caviare, olives, pickles, and cheese.

*Fruits and Nuts.*—Grape-fruit, lemons, sour cherries, c
berries, red currants, and nuts (except chestnuts) are allow
in small quantities.

*Sweetening Agents.*—Certain forms of sugar appear t
assimilable. Thus milk, although it contains a consider
quantity of lactose, is usually well borne. Levulose (se
473), also in moderate amounts, seems to be harmless.
chief substitutes for sugar are saccharin and glycerin.

**Hygienic Treatment.**—Fresh air and systematic exe
are of great value. The patient must be warned, how
against overexertion. Moderation must be observed i
things. Flannel should be worn next to the skin, and
undue exposure avoided. Massage has been strongly rec
mended. Hydrotherapy, as first suggested by Bouchard
decidedly efficacious. If the patient is vigorous, Turkish b
may prove useful. Diabetics who still possess a fair mea
of health frequently derive much benefit from a visit to ce
mineral springs, such as Neuenahr, Homburg, Carlsbad,
Vichy. Obese, gouty subjects often do remarkably wel
Carlsbad.

**Medicinal Treatment.**—The medicinal treatment of diabetes is purely empiric. The drugs which have been shown to be of most value are opium, bromids, salicylic compounds, antipyrin, alkalis, and arsenic.

Opium is generally the most reliable drug, especially in the severe nervous cases. It relieves thirst, promotes sleep, allays restlessness, and diminishes the excretion of urine and sugar. Patients can often take with advantage from 5–8 gr. (0.3–0.5 gm.) a day. Upon the disappearance of the symptoms it should be gradually withdrawn. Saline aperients may be associated with it, when necessary, to prevent constipation. Codein is sometimes preferable to opium. Doses of ½ gr. (0.03 gm.), thrice daily, may be gradually increased until the glycosuria disappears or ceases to be affected.

Bromids, either alone or as adjuvants to opium, are very useful in subduing nervous symptoms. Salicylic compounds rank next in efficacy to opium. While they yield the best results in gouty cases, their good effects are by no means limited to that class. From 40–80 gr. (2.5–5.0 gm.) of strontium or ammonium salicylate may be given in the twenty-four hours. This treatment should be discontinued upon the slightest evidence of intolerance.

Some cases do remarkably well upon antipyrin in doses of from 10–15 gr. (0.6–1.0 gm.) thrice daily. It may often be combined advantageously with an alkaline carbonate, salicylate, or bromid.

Alkaline carbonates and alkaline mineral waters have long enjoyed a reputation as remedies in diabetes. While they do not appear to have a decided influence on the glycosuria, they often relieve dyspeptic symptoms and constipation and tend to avert coma. Arsenic, especially in the form of the so-called bromid of arsenic or Clemens' solution (see p. 312), occasionally succeeds when other remedies fail.

Cod-liver oil, strychnin, iron, and alcohol are useful at times in meeting special indications.

Among other remedies which have been recommended, but which are of somewhat doubtful utility, may be mentioned: Jambul (Banatvala), uranium nitrate (West), glycolytic ferment from the pancreas (Lépine), ergot (Dougall), and calcium carbonate and phosphate (Grube).

**Special Symptoms.**—*Constipation* is best treated by saline cathartics or the alkaline mineral waters. Remedies which lessen the polyuria also serve to quench the *thirst*. Acidulous drinks are sometimes of service.

*Pruritus of the genitals* should be treated by frequent spong-

ing, especially after micturition, with a saturated solution boric acid. Lotions containing carbolic acid, resorcin (see 393), or sodium hyposulphite may also be tried.

*Diabetic Coma.*—When coma is threatened, prophylac treatment consists in substituting milk with some carboh drate for the strict proteid dietary, in the administration sodium bicarbonate,—an ounce (31.0 gm.) or more a day,— keeping the bowels freely opened with saline aperients, and sustaining the circulation with strychnin and whisky. In t presence of actual coma treatment is usually unavailing. T most useful measure is the intravenous injection of a 2 to 3 p cent. solution of sodium bicarbonate to the extent of 1 o pints (0.5–1.0). To insure rapid action of the bowels, a br cathartic (croton oil) should be given. Hypodermic injectio of ether and strychnin are useful. The inhalation of oxyg has been highly recommended.

## DIABETES INSIPIDUS.

The hygienic treatment suggested for diabetes mellitus applicable in diabetes insipidus. The patient should hav nutritious but digestible diet. No benefit is derived from stricting the quantity of water desired. Acidulated drin like lemonade, aid in assuaging thirst. Many remedies h been recommended; those possessing the most exten reputation are opium (4–8 gr.—0.25–0.5 gm. a day), vale (½–1 fl. oz.—15.0–30.0 c.c. of ammoniated tincture daily), er (½–1 dr.—2.0–4.0 gm. of the extract or of ergotin daily), a pyrin (10 gr.—0.6 gm. three or four times a day), be donna (5 min.—0.3 c.c. of the tincture three times a day, dose being gradually increased), and gallic acid (1 dr.—4.0 a day). Galvanism—one pole applied to the neck and the ot to the loins—has also been recommended. Tonics—cod-li oil, iron, and strychnin—are sometimes required. In syphi cases good results may be anticipated from a thorough trial mercury and potassium iodid. The dryness of the skin r be relieved by warm baths, followed by inunctions with o oil (Saundby).

## GOUT.

**Chronic Gout.**—No absolute rule can be laid down rega ing the diet. The special features in each case should rec careful study. Some patients do well upon a non-proteid d others do not. Simplicity and moderation are of the utm importance. Generally speaking, a diet composed for

most part of milk, farinaceous foods, succulent vegetables, eggs, fish, and lean meats is most suitable. The foods most likely to disagree are veal, liver, sweetbreads, hashes, croquettes, concentrated soups, vegetables rich in nucleins,—peas and beans,—pastry, sweets, coffee, malt liquors, and heavy wines. Some patients are exceedingly intolerant of acid fruit. Milk taken as a beverage at meals is objectionable. Alcoholic stimulants, as a rule, should be avoided; occasionally, however, a small quantity of well-diluted whisky at meals aids digestion and is well borne. Water-drinking between meals should be encouraged.

The quantity as well as the character of the food must be regulated. No more should be eaten than is absolutely necessary to satisfy hunger. The patient should be warmly clothed and should avoid as far as possible exposure to sudden atmospheric changes. Systematic exercise in the open air is extremely beneficial. Well-nourished patients should be urged to take walking trips, to play golf or tennis, or to try horseback riding. When active exercise is not feasible, massage may be strongly recommended. All overwork of mind should be forbidden. Hydrotherapy—tepid sponge-baths and douches —is useful. Heavy robust patients often derive much benefit from the Turkish bath.

Visits to certain mineral springs—Bedford, Saratoga, Harrowgate, Carlsbad, Contrexeville, Aix-les-Bains—are sometimes of the greatest value. The good effects of the spa treatment are only in part due to the waters drunk: change of scene, fresh air, strict diet, and freedom from business and household cares are important factors. Residence during the winter months in a dry, warm, inland climate is desirable.

Remedies calculated to improve digestion are frequently indicated. In some cases a combination of an alkali with a bitter (see p. 175) before meals is of much service. Daily action of the bowels should be secured. The occasional use of calomel or blue-mass at night, with a saline in the morning, is often of value. Among the special remedies advocated for gout may be mentioned alkalis and alkaline mineral waters, colchicum, guaiac, arsenic, and iodids.

Of these, the alkalis, especially the vegetable salts of potassium, are the most useful (see pp. 226, 231, 243). Colchicum is most effective in the acute paroxysms, although small doses with alkalis may be of benefit in the interval. Guaiac (see p. 338) probably ranks next in efficacy to the alkalis. The prolonged use of arsenic in small doses has seemed to us to be of some value. Iodids are sometimes of service in relieving

the concomitants and sequels of gout,—arthritis, bronchiti arteriosclerosis,—but have little, if any, effect upon the disea itself. Salicylates relieve pain, but are distinctly inferior t colchicum. Such remedies as piperazin, lycetol, and quin acid (see p. 244) are of doubtful utility.

Chronic affections of the joints are best treated by gent massage, friction, and warm sulphur baths.

**Acute Gout.**—The most efficient remedy is colchicun from 5–10 min. (0.3–0.6 gm.) of the wine may be given w diluted three or four times a day. It should be stopped soon as relief is obtained. Alkalis are useful adjuvants (f formula, see p. 338). Water-drinking should be encourage At the outset a brisk mercurial purgative, followed by a salir is usually advisable. Excruciating pain will demand the u of morphin. Phenacetin is sometimes effective. The d should be light and non-stimulating.

The affected part should be elevated and wrapped in cotto wool or covered with cloths soaked in lead-water and laudanu

## CHRONIC RHEUMATISM.

Strict attention should be paid to hygiene. The patie should be warmly clothed, wool or silk being next to the sk and great care should be taken to guard against wet and su den changes of temperature. The food should be nourishir but digestible. Fatty foods, when well borne, are of mu value. Hot sulphur and hot saline baths are often very u ful. Massage and Swedish movements are excellent adjuva to hydrotherapy. Vigorous patients may be benefited Turkish baths. Residence in a dry, warm, equable climate Southern California, Arizona, Riviera, Egypt—especially d ing the changeable seasons, is always desirable.

Tonics and certain alteratives, such as cod-liver oil, iron, a arsenic, are the most generally useful internal remedies. Iodi are sometimes of service, but on the whole they are infer to arsenic. Salicylates are efficacious in relieving acute e acerbations, but they have no permanent effect. Colchicum useless. Guaiac, sulphur, cimicifuga, ichthyol, and many oth drugs have been recommended.

**Local Treatment.**—Massage, if employed systematical often accomplishes much good. Superheated air-baths a occasionally useful. Electricity is of little value. Rubefacie liniments have a palliative influence in mild cases. An oi ment of mercury, belladonna, and ichthyol, well rubbed ir

the affected part, is sometimes very efficacious. When the pain is severe and persistent, blisters or light applications of the actual cautery prove effective.

## MUSCULAR RHEUMATISM.

In mild cases it will suffice to put the affected muscles at rest. In pleurodynia this is accomplished best by strapping the affected side as in fracture of the ribs, and in lumbago by applying a large piece of adhesive plaster from the floating ribs to the iliac crests. In more severe cases it will be necessary to apply rubefacient liniments, sinapisms, or, better still, hot fomentations, and to administer a salicylate, combined, perhaps, with a coal-tar analgesic:

℞ Salophen, ʒij (8.0 gm.);
Acetphenetidini, ʒj (4.0 gm.). M.
Fiant chartulæ No. xii.
Sig.—One every three hours.

A rubefacient ointment like the following is often efficacious:

℞ Methylis salicylatis, ʒss (2.0 c.c.);
Guaiacolis, ♏xx (1.3 c.c.);
Mentholis, gr. xx (1.3 gm.);
Adipis, ʒij (8.0 gm.);
Cerati, ʒiiss (10.0 gm.). M.
Sig.—Rub in a small quantity over seat of pain twice daily.

A blister is occasionally required. When the pain is intense, hypodermic injections of morphin ($\frac{1}{4}$ gr.—0.016 gm.) with atropin ($\frac{1}{120}$ gr.—0.0005 gm.) will afford great relief. In lumbago, acupuncture (see p. 438) sometimes yields excellent results. Hot packs and baths are often efficacious, but great care must be exercised to guard against exposure after their use. Persistent myalgia is often very favorably affected by massage and applications of the faradic current. In chronic cases, potassium iodid and guaiac should be tried. Gelsemium in large doses (Brunton) and ammonium chlorid (Anstie, Ringer, Roberts, DaCosta) have also been recommended.

## RHEUMATOID ARTHRITIS.

The most that can be expected from treatment is amelioration of the symptoms, and, perhaps, some retardation of the progress of the disease. The hygienic treatment is as for

chronic rheumatism (see p. 544). An important indication is to maintain nutrition. Tonics are frequently necessary. Cod-liver oil in such doses as the stomach will tolerate is often very beneficial. The most satisfactory special agents are arsenic and the iodids, particularly the former. Garrod has repeatedly seen good effects follow the prolonged use of the syrup of ferrous iodid. Luff, in a large experience with the disease, has found guaiacol carbonate, 5 gr. (0.3 gm.), gradually increased to 15 gr. (1.0 gm.), thrice daily, an excellent adjuvant to the iodids. The remedies relied upon in gout are useless in rheumatoid arthritis. Salicylates are sometimes of service in acute exacerbations. Change of scene and climate, especially in the early period of the disease, frequently exerts a favorable influence. Visits to hot mineral springs (Hot Springs of Virginia or Arkansas, Bath, Baden-Baden) are recommended.

**Local Treatment.**—Massage is of the greatest value in preserving the mobility of the joints and in maintaining the nutrition of the muscles. Acute exacerbations should be treated by rest and the application of cold compresses. Rubefacient liniments, inunctions with mild iodin or mercurial ointment and small blisters are sometimes of benefit. The Bier method of producing hyperemia has been highly recommended. Electricity and superheated air occasionally afford much relief; the rays have yielded good results in a few instances.

## RHACHITIS.

The treatment of rhachitis is mainly dietetic and hygienic. If the mother is deemed unfit for nursing, the child must be brought up by a wet-nurse or by hand. In most cases the latter method must be chosen. Generally speaking, the best substitute for natural food is diluted fresh cows' milk to which have been added cream and milk-sugar. The degree of dilution and the percentage of cream and sugar to be added will vary with the age of the infant and its power of assimilation. Lime-water and barley-water are the best diluents. Milk that has been partially predigested is in many cases an excellent food. Older children require undiluted milk, cream, beef-juice, veal-broth, eggs, scraped beef, pounded mutton, and fruit-juices. Starchy foods should be avoided. Very often it is necessary to correct digestive disturbances before ordering a liberal diet.

Fresh air, day and night, is essential. The child should be carefully protected, however, from the vicissitudes of the weather, and should be warmly clad in flannel. Sea-air is often very beneficial. Daily bathing, with friction and gentle massage, is to be recommended.

Dyspepsia, diarrhea, and constipation should receive appropriate treatment. When well borne cod-liver oil is the best remedy. The dose should be increased gradually from a few minims to a teaspoonful, three or four times a day. When cod-liver oil cannot be taken by the mouth, it may be given by inunction (see p. 305). Phosphorus, which has been strongly recommended by Kassowitz and Jacobi, is of doubtful value (see p. 300). The lactophosphate and hypophosphite of calcium are frequently combined with cod-liver oil for their tonic effect. Stoeltzner has obtained good results from the use of suprarenal extract, and Mendel, from the use of thymus extract. When there is anemia, an unirritating preparation of iron should be given. For the excessive sweating, atropin, in doses of $\frac{1}{800}$ of a grain (0.0008 gm.) two or three times a day, has been recommended (Holt).

## DISEASES OF THE BLOOD AND DUCTLESS GLANDS.

### CHLOROSIS.

Fresh air, sunlight, open-air exercise, and nourishing food are valuable aids in treatment. Change of climate or a sea-voyage is often beneficial. Very severe cases sometimes require complete rest in bed and massage. If there be a good reaction, warm baths, followed by short cold douches, are efficacious. Iron is almost a specific. It is most frequently prescribed in the form of Blaud's pills (see p. 292), of which the dose is three pills, gradually increased to nine a day. In some cases other preparations of iron, such as iron and ammonium citrate, ammonioferric tartrate, albuminate, and pyrophosphate, are better borne. Laxatives, preferably mild salines, rank next in importance to iron. Arsenic is distinctly less valuable than iron. Bitters, such as nux vomica, gentian, and calumba, are often useful adjuvants, especially when there is anorexia with tardy digestion. Superacidity of the gastric juice is best treated by alkalis.

### PERNICIOUS ANEMIA.

While the outlook in pernicious anemia is exceedingly grave, marked improvement and even apparent recovery are not impossible. Fresh air, rest, and a diet as liberal as the digestive power of the patient will permit, are requisite. Rest in bed, warm salt baths, and massage are valuable adjuvants to internal treatment. The teeth should receive careful attention. If there be gingivitis or pyorrhœa alveolaris, antiseptic mouth-washes should be used at frequent intervals.

Arsenic is the most valuable drug. It may be given in the form of Fowler's solution, the dose being gradually increased from 2 or 3 min. (0.1–0.2 c.c.) to 15 or 20 min. (1.0–1.2 c.c.) three times a day. Iron is rarely of service, but may be tried when arsenic fails. Bone-marrow is sometimes efficacious. Dock has often used mercuric chlorid with benefit, not only in syphilitic cases, but also in others. Inhalations of oxygen have been recommended (Shattuck). Appropriate anthelmintic remedies should be given, of course, in the cases in which intestinal parasites (Bothriocephalus latus, ankylostoma) are present. Digestive disturbances are often benefited by the administration of diluted hydrochloric acid and a bitter.

## LEUKEMIA, PSEUDOLEUKEMIA, AND SPLENIC ANEMIA.

An effort should be made to maintain the general nutrition by regulating the diet and attending to hygienic measures. Rest is often advisable. Among drugs, arsenic appears to be of some service. Iron, quinin, and cod-liver oil occasionally are beneficial. Inhalations of oxygen may be tried. In pseudoleukemia Gowers and Broadbent have found phosphorus of benefit. In leukemia, repeated applications of the Röntgen rays are sometimes followed by marked improvement, and even a symptomatic cure. A relapse, however, is to be expected. According to Stengel and Pancoast, the best results are achieved when the rays are applied to the bones, various portions of the body being treated in succession, and the spleen not exposed until it is reduced considerably in size and the patient's general condition is much improved, and even then only with caution. In neither leukemia nor pseudoleukemia is operative treatment of avail. In splenic anemia, however, removal of the spleen is a justifiable procedure. Of 32 cases of splenic anemia treated by splenectomy, in 23 recovery followed (Armstrong).

## SCURVY.

The prime requisites in the treatment of scurvy are suitable nourishment and proper hygiene. Complete rest is generally advisable. The diet should include plenty of fresh vegetables—potatoes, lettuce, cabbage, and onions,—with 3 or 4 ounces (90–120 c.c.) of lemon-juice daily. When the digestion is feeble and the gums are tender, it may be necessary to restrict the diet to such foods as beef-juice, animal broths, milk, raw eggs, and orange- or lemon-juice. Tonics, like iron, quinin and strychnin, are often of service. In some cases alcoholic stimulants are required. The mouth should be cleansed a

frequent intervals with some antiseptic wash, such as Dobell's solution, and the spongy gums should be painted two or three times a day with a solution of silver nitrate, 20 grains (1.3 gm.) to the ounce (30.0 c.c.).

Infantile scurvy usually responds very promptly to correction of the diet. The foods most worthy of confidence are fresh cows' milk, beef-juice, and orange-juice.

### PURPURA HAEMORRHAGICA.

In many cases a favorable termination follows in the course of one or two weeks without special medication, while in others the disease progresses toward a fatal issue in spite of the most careful treatment. Hemostatics, both internal and external (see p. 377), are the remedies indicated. Great efficacy has been claimed especially for oil of turpentine, gelatin, and calcium chlorid. Heart-failure should be treated by cardiac stimulants, and restlessness and insomnia by opium in small doses. Secondary anemia will require iron and arsenic.

### HEMOPHILIA.

The treatment of hemophilia is largely protective and palliative. All operations liable to cause hemorrhage should be avoided. Bleeding will call for rest, the application of cold compresses and of styptics, and the administration of internal hemostatics (see p. 377). The drugs most worthy of confidence are, perhaps, gelatin and calcium chlorid. Weil, Labbe, and others have found fresh blood-serum markedly efficacious. It may be given in doses of 20 to 30 c.c. subcutaneously. The effect of the serum is at its height in twenty-four hours and lasts several weeks. The serum should not be over two weeks old; human, horse, or rabbit serum may be used. In default of other varieties, fresh antidiphtheria serum may be employed. Combemale and Gaudier and Delace have used thyroid extract with asserted good results. Inhalations of oxygen have been strongly recommended. Wright advises inhalations of carbon dioxid when there is epistaxis. The resulting anemia is benefited by iron and arsenic.

### ADDISON'S DISEASE.

As the primary lesion in Addison's disease is not amenable to therapeutic measures, little can be done beyond maintaining the patient's strength and relieving symptoms. Nutritious but readily digestible food, the avoidance of mental and physical excitement, and good hygienic surroundings are important

factors in the treatment. When there is marked asthenia, absolute rest should be enjoined. Very marked improvement in the symptoms sometimes follows the administration of suprarenal extract (see p. 68). Tonics, like iron, arsenic, and strychnin, are of service. Irritability of the stomach will call for such sedatives as bismuth subnitrate, hydrocyanic acid, and cerium oxalate, and diarrhea for mild astringents and antiseptics.

## MYXEDEMA.

As patients with myxedema are extremely susceptible to low temperatures, they should be warmly clad and protected from exposure to cold. Residence during the winter in a warm, sunny climate is desirable. Warm baths are often beneficial. Modern treatment consists in the administration of some preparation of thyroid gland (see p. 343). By continuing this remedy throughout life it is possible in many cases to hold the symptoms in complete abeyance.

## EXOPHTHALMIC GOITER.

The general nutrition should be improved by rest, a generous, readily digestible diet, healthy hygienic surroundings, and hydrotherapy. Residence in a warm seaside locality often promotes comfort and aids recovery. In severe cases absolute rest in bed is an essential point in the treatment. Applications of cold to the precordia, by means of Leiter's tubes or ice-bags, lessen the palpitation.

Medicinal treatment is very uncertain. A drug that has been efficacious in one case may in another prove useless or harmful. Belladonna, recommended by Gowers, is undoubtedly of value in many cases. It should be given in ascending doses until some dryness of the throat is produced. When the circulation is feeble, digitalis may be found of service; on the other hand, when the heart is strong, better results may be obtained with aconite or veratrum viride. When anemia exists, iron is useful. Bromids are sometimes of service in controlling nervous symptoms. Starr has observed marked improvement from the use of sodium glycerophosphate in doses of 20 grains (1.3 gm.) three or four times a day, as originally recommended by Trachewsky. Mikulicz, Owen, Mackenzie, and others have found thymus extract (see p. 344) of some value. Musser has found small doses of opium successful in some cases. Among other remedies which have been recommended, but which are of more doubtful value, may be mentioned ergot, iodids, quinin hydrobromid, and

bromid of gold. The consensus of opinion is decidedly adverse to the use of thyroid extract.

Specific antithyroid therapy has given encouraging results in a fairly large number of cases. The preparations chiefly used have been Moebius' serum (serum from thyroidectomized animals), thyroidectin (dried blood of thyroidectomized animals), rodagen (dried milk of thyroidectomized goats), and Beebe's and Rogers' serum (serum from horses inoculated with nucleoproteids and thyroglobulin from pathologic and normal thyroids). All these preparations are expensive. Of 86 patients receiving specific treatment, except that of Beebe and Rogers, 80 were benefited and 6 were not (Bulkeley). Beebe and Rogers report 90 cases in which their serum was used, with the following results: 23 patients were cured, 52 improved, 11 not benefited, and 4 died.

Galvanism (see p. 483) sometimes proves more effective in controlling the symptoms than any other remedy. Recently some very favorable results have been reported from the use of *x*-rays. Finally, after other measures have been given a thorough trial, operative interference should be considered. According to Rehn, in 177 partial excisions of the gland 57.6 per cent. of the patients were cured, 26.5 improved, 2.3 per cent. unimproved, and there were 13.6 per cent. of deaths. In 32 resections of the sympathetic 31.1 per cent. were cured, 50 per cent. were improved, 12.5 per cent. were unimproved, and death occurred in 9.5 per cent. After ligation of the thyroid arteries in 14 cases 24 per cent were cured, 50 per cent. improved, and the remainder died. Of 59 cases operated on by Kocher, 45 were cured, 8 were decidedly improved, 2 were slightly improved, and 4 died from tetany as a result of the operation. Halstead has operated on 90 patients with 2 deaths and Mayo on 176 patients with 8 deaths.

## DISEASES OF THE DIGESTIVE TRACT.

### STOMATITIS.

The source of the local irritation should be sought for and removed. Errors of hygiene should be corrected. The diet and the state of the alimentary tract should receive careful attention. The mucous membrane of the mouth should be washed at frequent intervals with cool antiseptic solutions. In mild *catarrhal stomatitis* a solution of boric acid, 5–10 gr. (0.3–0.6 gm.) to the ounce (30.0 c.c.), will suffice. In obstinate cases the mouth, after being carefully cleansed, may be lightly painted

with a solution of silver nitrate, 4 gr. (0.26 gm.) to the ounce (30.0 c.c.). Ulcers may be touched with solid silver nitrate or copper sulphate.

In *aphthous stomatitis* a mild mercurial aperient is often of service. In addition to the frequent use of antiseptic washes (boric acid, potassium permanganate), the occasional application of silver nitrate—10 gr. (0.6 gm.) to the ounce (30.0 c.c.)—is desirable.

In *thrush* the mouth should be cleansed at frequent intervals, especially after every feeding, with one of the following solutions: sodium hyposulphite, 20 gr. (1.3 gm.) to the ounce (30.0 c.c.); boric acid, 15 gr. (0.9 gm.) to the ounce (30.0 c.c.); or potassium permanganate, 1 gr. (0.065 gm.) to the ounce (30.0 c.c.).

In *ulcerative stomatitis* potassium chlorate is almost a specific. It should be used both locally and internally (see p. 231). The ulcers may be painted with a solution of silver nitrate, 10 gr. (0.6 gm.) to the ounce (30.0 c.c.). Tonics, like quinin and iron, are called for in some instances.

*Gangrenous stomatitis* demands energetic treatment. The sloughing surface and the tissue immediately surrounding it should be promptly destroyed under anesthesia with the actual cautery or strong nitric acid. After the operation the mouth should be cleansed at frequent intervals with a solution of hydrogen dioxid (1 : 3) or of potassium permanganate (1 per cent.). Concentrated nutritious food, stimulants, and tonics are urgently indicated.

The treatment of *mercurial stomatitis* has already been considered (see p. 323).

## ACUTE PHARYNGITIS.

In mild cases a gargle of potassium chlorate (see p. 368) will suffice. In severe cases the application to the throat of cloths wrung out of cold water proves grateful. The sucking of pieces of ice affords much relief. Gargles or sprays of the distillate of hamamelis (50 per cent.) are useful. A spray of menthol, 2 gr. (0.13 gm.) to the ounce (30.0 c.c.) of liquid petrolatum, is also efficacious. Lozenges containing cocain will often relieve pain and allay the tickling sensation in the throat. The following formula, recommended by Bosworth, answers the purpose admirably:

℞ Cocainæ hydrochloridi, gr. v (0.3 gm.);
Extracti krameriæ, gr. ij (0.13 gm.);
Sodii bicarbonatis, gr. xv (1.0 gm.);
Extracti glycyrrhizæ, ʒiiss (10.0 gm.). M.
Fiant trochisci No. xxx.

Internally, a mild aperient may be given at the outset. Sodium benzoate has a beneficial effect. From 5–10 gr. (0.3–0.6 gm.) may be given every three hours. Belladonna with aconite is also recommended. The rheumatic form usually yields promptly to a mild salicylic preparation, like salophen.

### CHRONIC PHARYNGITIS.

The removal of the cause is of prime importance. All sources of local irritation, such as misuse and overuse of the voice, mouth-breathing, excessive smoking, and intemperance in eating and drinking must be avoided. Patients should be instructed to expel sounds by the aid of the diaphragm and abdominal muscles instead of the muscles of the throat. Nasal obstructions and adenoid growths must be removed. The habit of hawking and scraping to clear the throat should be rigidly interdicted. Digestive disturbances should receive careful attention. Tonics, like iron, strychnin, and cod-liver oil, are sometimes required.

**Local Treatment.**—The nasopharynx should be kept clean by frequent spraying with an antiseptic alkaline liquid, like Dobell's solution (see p. 172). Astringent applications are often of service; one of the following may be employed: Zinc sulphate, 5 gr. (0.3 gm.) to the ounce (30.0 c.c.); tannin, 1 dram (4.0 gm.) to the ounce (30.0 c.c.) of glycerin; silver nitrate, 10–20 gr. (0.6–1.3 gm.) to the ounce (30.0 c.c.). In the follicular variety it is advisable to destroy the enlarged follicles by means of the galvanocautery, after which the astringent applications may be made.

### ACUTE TONSILLITIS.

The patient should be confined to a warm room, and, if there be much fever, to bed. A mild aperient is indicated at the outset. The diet should be light but sustaining. The sucking of ice affords relief. The most reliable internal remedies are the salicylic compounds and sodium benzoate. They should be given in full doses at frequent intervals. Guaiac is also recommended. A dram (4.0 c.c.) of the ammoniated tincture of guaiac may be given in milk every three hours. Febrile symptoms, if pronounced, may be controlled by small doses of phenacetin or by a combination of aconite and spirit of nitrous ether (see p. 63). The pain may be so intense as to require the use of opium.

**Local Treatment.**—Externally, cold applications aid in bringing about resolution; if, however, suppuration be inevi-

table, warm applications should be employed to hasten the process. Antiseptic sprays, like Dobell's solution (see p. 172) or a solution of hydrogen dioxid (1 : 4), are of benefit. Direct applications to the surface of the glands of the tincture of ferric chlorid—1 dram (4.0 c.c.) to the ounce (30.0 c.c.) of glycerin or of a saturated ethereal solution of iodoform—are often useful. The treatment of follicular tonsillitis by the thorough application of very finely powdered aspirin, after the glands have been mopped with a warm solution of sodium bicarbonate, as recommended by Kieffer and Fetterolf, gives excellent results. Applications of dry sodium bicarbonate have also been highly recommended.

Pus should be evacuated as soon as its presence can be detected. In the majority of cases it is best to make the incision not in the tonsil itself, but in the soft palate, a little above and to the outer side of the gland.

## ACUTE CATARRHAL GASTRITIS.

Absolute rest is essential. If the stomach has not been completely emptied, an emetic, such as warm water or ipecac should be employed. Locally, a mustard plaster or a turpentine stupe will aid in relieving distress. As a rule, no food should be given by the mouth until the stomach becomes retentive. Ice, however, may be allowed to quench the thirst. In delicate subjects nutrient enemata will be required. If there be constipation, a mercurial laxative may be given with advantage. Such a combination as the following usually acts favorably:

℞ Hydrargyri chloridi mitis, gr. j (0.065 gm.);
Bismuthi subnitratis, gr. xx (1.3 gm.). M.
Fiant chartulæ No. vj.
Sig.—One on the tongue every hour, to be followed by a Seidlitz powder, if necessary.

Pain, nausea, restlessness, and insomnia are best relieved by opium suppositories or hypodermic injections of morphin. Sedatives by the mouth are also useful; thus, bismuth subnitrate may be given alone or combined with hydrocyanic acid (see p. 161), with creosote (½ min.—0.03 c.c.), or with cocain (1/6 gr.—0.01 gm.). The following combination of ipecac and nux vomica is often serviceable:

℞ Tincturæ nucis vomicæ,
Vini ipecacuanhæ, aa fʒij (8.0 c.c.). M.
Sig.—Two drops every hour.

After the lapse of twenty-four or thirty-six hours it is generally possible to give bland nourishment by the mouth. Barley-water, champagne with soda-water, milk and lime-water, peptonized milk, and light broths may be given in small quantities at frequent intervals. The return to solid food should always be carried out very gradually.

## INDIGESTION.

The first thing to be done in the treatment of all cases of indigestion is to find its cause, and to remove this, if possible. In many cases indigestion is merely a symptom of some constitutional disturbance, such as anemia, tuberculosis, Bright's disease, or diabetes, or is the result of passive hyperemia of the stomach induced by chronic cardiac, hepatic, or pulmonary disease. It is obvious that in such cases treatment must be directed very largely to the underlying condition. In the primary form of gastric indigestion the methods of eating and the character of the food are the factors of greatest importance. Regularity in the time of meals, slowness in eating, and thorough mastication of food must be insisted upon. The patient should be cautioned against overeating and the taking of large quantities of liquid, especially of iced water, during meals. Overindulgence in alcohol, tobacco, coffee, and tea should be forbidden. The resumption of mental or physical work immediately after meals should also be avoided.

**Dietetic Treatment.**—It is impossible to lay down any absolute rules in the matter of diet. The conditions present in each case must receive careful study, and considerable allowance must be made for individual peculiarities. Generally speaking, such articles as fried meats, salted meats, pork, veal, hashes, croquettes, coarse vegetables and fruits, fried or boiled sweet and white potatoes, fresh bread, pastry, puddings, nuts, and malt liquors must be interdicted. In many cases of *atonic dyspepsia* (*subacidity*), *nervous dyspepsia*, and *mild gastric catarrh* an ordinary mixed diet of readily digestible food is admissible. It may usually include boiled, baked, or grilled beef and mutton, chicken, sweetbread, boiled fish, oysters, soft-boiled or poached eggs, stale bread, toast, pulled bread, fresh butter, baked potato, young string-beans, small peas, spinach, hearts of celery, thoroughly cooked cereals (rice, wheat, oatmeal), baked apples, calves'-foot jelly, and junket. Tea, coffee, and cocoa may or may not be permissible.

Indigestion associated with *hyperacidity* will require a bland, unirritating diet, composed largely of albuminous foods. A

moderate quantity of water or weak tea at meals is desirabl
Condiments, spices, acids, oils, and alcoholic beverages a
strongly contraindicated.

When the *expulsive power of the stomach is weak* and the
is a tendency to *retention*, the food should be nutritious an
concentrated. Foods that are bulky and are liable to ferme
should be avoided. Much fluid is undesirable.

An exclusive milk diet sometimes acts exceedingly well
nervous dyspepsia and indigestion attended by hyperacidit
It is contraindicated when there is marked hypo-acidity, mot
insufficiency, retention, or intestinal fermentation.

Most cases do best without alcohol, but when there is pr
nounced subacidity or motor insufficiency, a small amount
diluted whisky, brandy, or sherry with meals may prove ben
ficial. Alcohol in any form is contraindicated when there
excessive secretion of acid or when there is hyperesthesia
the gastric mucosa.

Generally, it is best to prescribe a definite bill-of-fare and
modify this from time to time as occasion demands. In d
termining the suitability of a given diet we must be guid
chiefly by the patient's sensations and the state of his gene
nutrition. As a rule, no more than three meals a day shou
be allowed. When there is a tendency to retention, howev
it may be advisable to give the food in smaller quantities a
at more frequent intervals. On the other hand, in some cas
of gastric catarrh with slow digestion it may be advantageo
to limit the number of meals to two a day.

**Hygienic Treatment.**—In a large number of cases sy
tematic exercise in the open air accomplishes much goo
Anemic and neurasthenic patients, however, may require t
"rest-cure." Hydrotherapy is often very serviceable. Ma
sage is also useful, especially when there is myasthen
Change of scene, a sunny climate, good hours, and freedo
from business worry and household cares often prove mo
beneficial than any other measure employed.

**Medicinal Treatment.**—In cases of *atonic dyspepsia* a
of *mild gastric catarrh with subacidity* the administration o
bitter—calumba, gentian, nux vomica, cinchona—some tim
before meals often proves efficacious. In many cases t
bitter may be combined advantageously with an alkali (see
175). Diluted hydrochloric acid, with or without pepsin, m
also be of benefit when there is *subacidity*. It should be giv
after meals.

When the *stomach is unnaturally sensitive* or when there
*supersecretion*, silver nitrate will be found a valuable remed

It may be given in pill form, with extract of hyoscyamus or of belladonna, half an hour before meals, or when this method of administration is not satisfactory, by means of the intragastric douche (see p. 372). Bismuth subnitrate in large doses before meals is also of service in such cases.

In *nervous dyspepsia* short courses of strontium bromid are sometimes efficacious. When *anemia* is marked, an unirritating preparation of iron may be given with advantage.

Systematic lavage (see p. 500) is of great value in certain cases, but it has been much abused. Its chief indications are *retention of food with fermentation, excessive secretion of mucus,* and *excessive secretion of acid.* When lavage cannot be tolerated, the stomach may be cleansed by a glass of hot alkaline water slowly sipped a half-hour or more before breakfast. *Motor insufficiency* is often benefited by strychnin. Intragastric faradism and the intragastric spray (Einhorn) may also be recommended in cases of *pronounced stagnation.*

**Symptomatic Treatment.**—*Deficient Secretion.*—When the digestive power is impaired owing to a deficiency of secretion, diluted hydrochloric acid with pepsin (see p. 182), taken shortly after meals, may be found useful. In many cases, however, better results are obtained from the administration of pancreatin with sodium bicarbonate.

*Hyperchlorhydria.*—Severe pain occurring at the height of digestion and caused by hyperacidity is best treated by the administration of an alkali (sodium bicarbonate or magnesia) in large doses. *Heartburn* and *pyrosis* are also relieved by alkalis.

*Flatulence and fermentation* are sometimes controlled by such antiseptic drugs as creosote, bismuth subsalicylate, bismuth betanaphthol, and thymol. The following combination is often of value:

℞ Creosoti, ℥ss (2.0 c.c.);
Bismuthi betanaphtholis, gr. c (6.5 gm.);
Strychninæ sulphatis, gr. ss (0.03 gm.);
Oleoresinæ zingiberis, ♏v (0.3 c.c.). M.
Pone in capsulas No. xx.
Sig.—One after meals.

*Vomiting* usually yields to rest and proper diet. If troublesome, sedatives like bismuth subnitrate, hydrocyanic acid, and silver nitrate may be employed.

*Constipation.*—As far as possible constipation should be overcome by regulation of the diet, systematic exercise, and abdominal massage. Strong purgatives should be avoided.

A glass of water in the morning upon rising or in the evening before retiring often suffices in mild cases. If necessary, a small quantity of sodium phosphate or of the following artificial Carlsbad salt may be added:

℞ Sodii sulphatis, ℥x (40.0 gm.);
Sodii bicarbonatis, ℥iv (16.0 gm.);
Sodii chloridi, ℥ij (8.0 gm.). M.
Sig.—A teaspoonful in a glass of water an hour before breakfast.

One of the natural sulphated waters may often be used with advantage, especially when there is a tendency to excessive secretion of acid. Suppositories containing glycerin and enemata of warm water are harmless and generally effective. In some cases mild vegetable laxatives, like cascara sagrada and rhubarb, are required. The occasional use of calomel in small frequently repeated doses sometimes serves a good purpose.

## GASTRALGIA.

The hygienic and dietetic treatment described under Indigestion is applicable to gastralgia. Especially important is to forbid the excessive use of tobacco, tea, coffee, and alcohol. When the attacks show a tendency to occur midway between meals, the administration of 3 or 4 ounces (90.0–120.0 c.c.) of milk with lime-water, two or three hours after meals, is often of service.

**Treatment of the Attack.**—Stupes or hot compresses should be applied over the epigastrium. Internally, such remedies as chloroform (5–10 min.—0.3–0.6 c.c.), Hoffmann's anodyne (20–30 min.—1.2–2.0 c.c.), diluted hydrocyanic acid (2–3 min.—0.1–0.2 c.c.), and antipyrin frequently afford relief. The following combination will be found of value in many cases:

℞ Acidi hydrocyanici diluti, ♏xxxv (2.0 c.c.);
Antipyrinæ, ʒij (8.0 gm.);
Tincturæ opii camphoratæ, f ʒj (30.0 c.c.);
Aquæ chloroformi, q. s. ad f ʒiij (90.0 c.c.). M.
Sig.—A dessertspoonful in hot water.

If the pain be very severe, it will be necessary to resort to the hypodermic injection of morphin and atropin.

**Treatment.**—The two most useful remedies are silver nitrate and arsenic. The former should always be selected when there is hyperesthesia of the mucous membrane with hyperchlorhydria. It may be combined with belladonna, as in the following formula:

℞ Argenti nitratis, gr. v (0.3 gm.);
Extracti belladonnæ, gr. iv (0.26 gm.);
Mannæ, q. s.
Fiant pilulæ No. xx.
Sig.—One pill half an hour before meals.

The best preparation of arsenic is Fowler's solution, which should be given after meals in increasing doses.

Galvanism is sometimes of service; the anode may be placed over the epigastrium, and the cathode over the dorsal spine. Very severe cases may demand a complete change of scene and air or a modified "rest-cure."

Gastralgia depending upon anemia, locomotor ataxia, or malaria is to be treated, of course, on special principles.

## GASTRIC ULCER.

Rest and appropriate diet are the most important factors in the treatment of gastric ulcer. The rest should be kept up for from six to twelve weeks, and for the first two or three weeks of this period the patient should be confined to bed. If hemorrhage has recently occurred or if vomiting be urgent, it is advisable to withhold all food from the stomach for a few days and to nourish the patient by means of nutritive enemata. The following enema of Boas is usually well borne:

℞ Milk, 250 grams;
Yolk of two eggs,
Salt, 2 grams;
Claret, 15.0 cubic centimeters;
Baked flour, 15 grams.
Use 1 to 3 in twenty-four hours.

The following preparation suggested by Ewald is also useful: A tablespoonful of baked flour (dextrinized) is boiled with one-half of a glass of a 15 per cent. solution of glucose, and a wineglassful of claret is added. Two or three eggs, which have been beaten up with a tablespoonful of water and a pinch of salt, are stirred into the mixture after it has cooled sufficiently to prevent the coagulation of the albumin. The entire quantity should not measure more than ½ pint (0.25 L.).

After the pain and vomiting have sensibly abated, feeding by the mouth should be resumed. The diet should consist of milk, buttermilk, beef-juice, animal broths, egg-white, and thin pap. As soon as the gastric symptoms have completely disappeared, which will rarely be before the lapse of three or four weeks, the patient may be allowed such articles as soft-boiled eggs, scraped beef, boiled sweetbreads, the tender part of oysters, white meat of chicken, well-made gruel, and custard pudding.

**Medicinal Treatment.**—The most useful drugs are alkalis, silver nitrate, and bismuth subnitrate. The alkalis are useful in overcoming the superacidity of the gastric juice. Sodium bicarbonate is one of the best; it may be combined with magnesia or chalk, according as there is constipation or diarrhea. Artificial Carlsbad salt (see p. 558) is an excellent alkaline laxative; of this a teaspoonful or more may be taken in half a pint of hot water before breakfast. Silver nitrate and bismuth subnitrate undoubtedly possess some value, although they probably exert no specific influence on the ulcer itself. The two drugs may be given alternately, each for a period of a week or ten days (see pages 372 and 375).

Vomiting usually yields to complete rest, rectal feeding, and the administration of silver or bismuth. In some cases it may be necessary to use in addition a local sedative, like hydrocyanic acid (see p. 160) or cocain. Morphin administered hypodermically is often very efficacious.

Violent pain will also demand morphin, although the danger of inducing a habit must always be borne in mind. Externally, stupes or sinapisms are sometimes useful.

In the treatment of hematemesis absolute rest is essential. No food of any kind should be given by the mouth. An ice bag should be applied over the stomach and morphin should be given hypodermically. The application of firm bandages to the four extremities may act favorably. Ergot and local astringents like tannic acid, iron sulphate, and lead acetate are of very doubtful utility. Ewald and Minkowski have recommended rinsing the stomach with ice-water as a last resort. Collapse following hemorrhage will call for diffusible stimulants, the external application of heat, and subcutaneous and rectal injections of warm saline solutions.

Operative interference is rarely warranted unless the hemorrhage be repeated.

**Surgical Treatment.**—In all cases of perforation an operation should be done at the earliest possible moment. The mortality in 123 cases operated on for perforation since 18— was 47.15 per cent. (Bidwell). In a series of 18 cases operated on within twelve hours after perforation, and reported since 1896, the mortality was only 16.66 per cent. (Keen). When life is threatened by repeated hemorrhage, operation, in the interval between attacks (gastro-enterostomy or pyloroplasty) offers the best method of relief. Again, an operation (gastroenterostomy, pyloroplasty, or partial gastrectomy) should be considered if the disease does not yield to medical treatment and the life of the patient is endangered by malnutrition.

## GASTRIC CANCER.

**Medicinal Treatment.**—The medicinal treatment of gastric cancer is purely palliative. The chief indications are to maintain nutrition and to relieve distressing symptoms. In the early stages of the disease, when the pylorus is still free, a mixed diet of readily digested food is often well borne. Later, when there is retention, food should be selected which leaves but little residue in the stomach. Eggs, finely divided tender meats, sweet-bread, soft part of oysters, clear soups, calf's-foot jelly, and thin gruels are admissible. A small quantity of light wine with meals is sometimes very beneficial. Milk is often badly borne. If the stomach is unretentive recourse should be had to rectal feeding.

*Bitters*—nux vomica, calumba, gentian—may often be employed with advantage. Condurango (see p. 177) is an excellent stomachic, wholly lacking, however, in the specific properties with which it was at one time credited. In many cases, but by no means invariably, hydrochloric acid is a useful adjuvant to the bitters.

Lavage affords the very best means of relieving the distressing symptoms resulting from retention. Vomiting that is not dependent upon retention may be treated with such remedies as carbonated water, hydrocyanic acid, bismuth subnitrate, creasote, cerium oxalate, and chloroform. In obstinate cases rectal feeding may be required for a time. Acid eructations and flatulency are sometimes relieved by antacids and antiseptics, but in the majority of cases lavage is much more effective.

The pain, if severe, will require codein or morphin. Milder attacks may be relieved by lavage, the administration of antacids or of sedatives, like carbolic acid, hydrocyanic acid, or chloroform, and by the external application of hot compresses or stupes.

Constipation may be treated by simple enemata, glycerin suppositories, or by mild vegetable laxatives.

**Surgical Treatment.**—Statistics of the surgical treatment of gastric cancer do not present a very favorable showing, although the mortality of the operative procedures is diminishing year by year. There are but two operations to be considered—partial gastrectomy and gastro-enterostomy. The former is curative in its aim, the latter purely palliative.

In 291 cases of resection of the pylorus or of a portion of the stomach recorded between 1890 and 1898, the mortality,

according to Guinard, was about 35 per cent. Earlier intervention and improvement in technic has gradually lessened the mortality, and at present it is probably not more than 25 per cent. Unfortunately, very few patients have remained free from recurrence longer than three years after the operation. Wölfler cites 3 patients who lived over four years, 4 over five years, 1 over six years, and 2 over eight years.

Gastro-enterostomy is preferable to gastrectomy in cases with extensive adhesions or marked glandular involvement. Moynihan has reported 35 cases with 5 deaths, and Robson 34 cases with 3 deaths. When performed successfully, this operation affords great relief and may prolong life several months and, occasionally, even a year or two.

## DILATATION OF THE STOMACH.

The treatment of dilatation of the stomach is medical and surgical.

**Medical treatment** is frequently curative when there is no actual stenosis of the pylorus. The diet is of the first importance. Foods should be selected which are nutritious, which are not bulky, and which do not readily ferment. Tender meats, eggs, light cereals, fresh butter, cream, and toasted bread may usually be allowed. Milk is often badly borne and in many cases liquids of all kinds must be somewhat restricted, but it is rarely necessary to resort to the dry diet of Schroth and other writers. In severe cases predigested meat preparations are often of service. P. Cohnheim has found olive oil useful when spasm of the pylorus is a factor.

In the majority of cases it is best to limit the meals to three or four a day; occasionally, however, it will be found necessary to give the food in small quantities at frequent intervals. The time required for the stomach to empty itself should be ascertained in each case, and should be the guide in determining the number of meals a day.

To prevent retention, to control fermentation, and to cleanse the stomach no measure is so valuable as lavage (see p. 500).

In the cases due to atony, massage, exercise in the open air, and hydrotherapy are valuable aids. A carefully adjusted abdominal bandage nearly always affords comfort and gives mechanical support to the stomach. Faradization of the stomach is useful in promoting muscular contraction.

Few drugs are of value. Nux vomica may often be given with advantage. When there is hypo-acidity, diluted hydrochloric acid is indicated. Such remedies as creosote and the salicylic compounds are sometimes of benefit in checking fermentation, but the relief they afford is not to be compared to that obtained through systematic lavage. Constipation should be treated, as a rule, by simple enemata or by glycerin suppositories.

**Surgical Treatment.**—In the large majority of cases of non-obstructive dilatation medical treatment suffices. Occasionally, however, surgical intervention is demanded on account of persistent suffering and progressive emaciation. The operation indicated in these cases is gastroplication. In 15 cases collected by Keen (1898) all the patients recovered but one.

In cases of pyloric obstruction of a benign character an operation is indicated when it is impossible to maintain nutrition by proper medical treatment. As Loreta's digital divulsion of the pylorus has been largely abandoned, owing to its high mortality (31.1 per cent.), there may be said to be but two operations available—pyloroplasty and gastro-enterostomy. The mortality in 14 cases of pyloroplasty reported by Carle was 7 per cent., while Morison has reported 11 cases, and Mayo 8 cases without a death. When performed by a surgeon having exceptional skill, gastro-enterostomy, in benign affections, yields a mortality of less than 8 per cent. The question of operative intervention in malignant stricture of the pylorus has already been considered (see p. 560).

## CHRONIC CONSTIPATION.

In many cases chronic constipation can be successfully treated by attention to hygienic measures and by careful regulation of the diet without resorting to drugs. Not infrequently the normal activity of the bowels may be restored by repeated daily attempts at defecation at some special hour. Systematic exercise and cold bathing are of the greatest benefit. Abdominal massage, especially digital kneading in the direction of the colon, is often quite effectual. In persons with relaxed abdominal walls the wearing of a snugly-fitting binder will be found of service.

Food should be selected which leaves considerable undi-

gested residue. Green vegetables, oatmeal, corn-meal, whole-wheat bread, and cooked fruits are available. Oils may often be given with advantage. Water-drinking should be encouraged. In mild cases a glass of cold water taken in the morning shortly after rising may suffice.

When hygienic treatment proves insufficient, drugs will be required. Any underlying condition of which the constipation may be but a symptom should receive careful attention. General tonics, like iron and strychnin, are often indicated. Mineral waters, like Friedrichshall, Hunyadi János, or the milder Saratoga or Bedford waters, are very useful, but possess no special advantages over the saline laxatives (sodium phosphate, or Rochelle salt), when the latter are taken in small amounts well diluted. Enemata of soapy water or of glycerin, or suppositories of gluten, soap, or glycerin, often prove highly satisfactory. Vegetable cathartics are usually necessary in obstinate cases. The mild ones should always be tried first, and even with these considerable care should be exercised lest the patient comes to rely upon drugs to the exclusion of the hygienic and dietetic measures already indicated. Of the mild laxatives, cascara sagrada is one of the best; from 10 to 30 min. (0.6–2.0 c.c.) of the fluid extract, or a corresponding dose of an agreeable elixir, may be administered at bedtime and repeated, if necessary, in the morning. In some cases a combination of several laxatives acts better than any one singly. The drugs to be preferred for conjoint use are rhubarb, aloes, podophyllin, and euonymin. As adjuvants, nux vomica or physostigma may be added to overcome atony of the bowel, and belladonna or hyoscyamus to prevent griping. The most suitable combination must be determined in each case by experience. A pill, like one of the following, will generally be found efficacious:

℞ Resinæ podophylli, gr. iv (0.26 gm.);
Aloes purificatæ, gr. xx–xl (1.3–2.6 gm.);
Extracti nucis vomicæ,
Extracti belladonnæ, *āā* gr. iv (0.26 gm.). M.
Fiant pilulæ No. xx.
Sig.—One pill at bedtime.

℞ Pulveris rhei,
Extracti rhamni purshianæ, *āā* gr. xxiv (1.5 gm.);
Extracti euonymi, gr. xij (0.8 gm.);
Extracti physostigmatis,
Extracti belladonnæ, *āā* gr. iv (0.26 gm.). M.
Fiant pilulæ No. xxiv.
Sig.—One pill at bedtime.

℞ Aloini, gr. iv (0.26 gm.);
Pulveris rhei, gr. xxxvj (2.3 gm.);
Pulveris ipecacuanhæ, gr. vj (0.4 gm.);
Resinæ podophylli, gr. iij (0.2 gm.);
Extracti hyoscyami, gr. xij (0.8 gm.). M.
Fiant pilulæ No. xxiv.
Sig.—One pill at bedtime.

## ACUTE DIARRHEA.

**Acute Diarrhea in Adults.**—Rest in bed and the substitution of bland nourishment for the ordinary diet are all that is required in many cases. Boiled milk, milk and arrow-root, and mutton, veal, or chicken broth are suitable foods. If the patient is seen at the outset and there is reason to believe that irritant material is still present in the bowel, it is advisable to administer an unirritating purgative, such as castor oil, Epsom salts, or fractional doses of calomel. Occasionally a second dose of the purgative may be given with benefit. Externally, stupes or sinapisms are frequently efficacious.

If there be much pain, opium should be administered. Dover's powder and paregoric are deservedly popular preparations. If the diarrhea continue, mild astringents, like bismuth subnitrate and chalk, are indicated. They may be combined advantageously with an antiseptic, as in the following formulæ:

℞ Bismuthi subnitratis, ℥iij (12.0 gm.);
Bismuthi subsalicylatis, ℥j (4.0 gm.). M.
Fiant chartulæ No. xij.
Sig.—One powder every two or three hours.

℞ Salolis, ℥ss (2.0 gm.);
Bismuthi subnitratis,
Cretæ præparatæ, *aa* ℥ij (8.0 gm.);
Pulveris acaciæ, q. s.
Aquæ cinnamomi, q. s. ad f℥iij (90.0 c.c.). M.
Sig.—A dessertspoonful every two or three hours.

When opium is indicated, it is better to prescribe the drug separately, so that it may be discontinued more readily when no longer required. Preparations containing tannic acid are rarely needed, but when the discharges are very profuse and watery, small doses of tannalbin or of tannigen (see p. 356) may prove serviceable. Cases in which gastric indigestion is an important factor are often benefited by pancreatin in conjunction with bismuth subnitrate and an alkali. If the diarrhea shows a tendency to become chronic, mineral astringents, like silver nitrate and lead acetate, with opium, in pill form, will be found effective.

When there is reason to believe that the colon is especially

involved, local treatment is of the utmost value. Copious injections of warm water both cleanse the bowel and exert a soothing effect upon the irritated mucous membrane. Small enemata (1–2 oz.—30.0–60.0 c.c.) of starch-water with laudanum (5–10 min.—0.3–0.6 c.c.) are very useful. In subacute colitis enemata containing silver nitrate (see p. 372) often prove efficacious.

**Treatment of Acute Diarrhea in Infants.**—Preventive treatment is of the utmost importance. Improper food and faulty methods of feeding are the two prime factors in causing the disease. Fresh cows' milk containing a minimum number of bacteria to the cubic centimeter should form the basis of all food that is intended to replace healthy breast-milk. In summer the milk should be received from the dairyman twice in the day, if possible, and should be placed immediately in a good refrigerator and kept there until such times as it is wanted. In very warm weather it may be necessary to resort to sterilization or pasteurization as a further means of preservation, but it must be remembered that neither of these processes can remove from the milk any pre-existing impurities. The strength and quantity of the food and the number of meals per day must be carefully adapted to the infant's age and its digestive powers. As an additional precaution in extremely hot weather it may be advisable to dilute the milk a little more than usual in order to lessen the percentage of fats and proteids.

Next to purity and freshness of the milk, it is important to insist upon absolute cleanliness of all the feeding apparatus. The nursing bottle and rubber nipple should be thoroughly washed after each meal. The child should have a daily morning bath, and on very warm days it is advisable to give one or two tepid sponge baths (90° F.—32° C.) in addition to the ordinary bath. In summer, if the weather be good, the child should pass most of the time in the open air, protected, of course, from the winds and the direct rays of the sun.

The first indication in the treatment of the disease is to withdraw the milk at once, and to withhold it for several days or until the stools become quite natural. Indeed, in many cases it is well to suspend all nourishment for the first twenty-four hours, allowing nothing by the mouth but barley-water or plain boiled water. Subsequently, albumin-water, fresh beef-juice, veal broth, or a liquid peptone preparation may be given in lieu of milk. Milk feeding should always be resumed very gradually. Absolute rest in the recumbent position is essential. Removal to the seashore or mountains is often of the greatest benefit.

After the withdrawal of the milk, the next most important step in the treatment is the administration of a purgative like castor oil or calomel. Of these, calomel should be given the preference when the stomach is irritable. In many cases free purgation alone suffices to cleanse the bowel, but when the stools are offensive or there is marked toxemia enteroclysis should also be practised once or twice a day, according to the severity of the attack. In cholera infantum intestinal irrigation may be employed to meet several indications: to lower temperature, to combat collapse, to relieve the anhydremia, and to stimulate renal secretion (see p. 498). In choleraic forms of the disease lavage and hypodermoclysis are also of great value. In most cases of acute diarrhea it is necessary to follow the purge with a sedative astringent, like bismuth subnitrate or chalk. From 5–10 gr. (0.3–0.6 gm.) of one of these drugs may be given every two or three hours. Intestinal antiseptics (salol, bismuth salicylate, betanaphtol bismuth) are useful adjuvants. Some such combination as the following may be ordered with advantage:

℞ Bismuthi subnitratis, ʒij–iv (8.0–16.0 gm.);
Salolis, gr. xxiv (1.5 gm.);
Misturæ cretæ, f℥iij (90.0 c.c.). M.
Sig.—A teaspoonful every two hours.

A more active astringent, like tannalbin or tannigen, may be given in addition to the bismuth subnitrate or chalk when the discharges are exceedingly profuse and watery.

In ileocolitis intestinal irrigation may be followed by injections of 1 or 2 ounces (30.0–60.0 c.c.) of a solution of silver nitrate (½ gr. to the ounce—0.03 gm.–30.0 c.c.), of from ½ to 1 ounce (15.0–30.0 c.c.) of a mixture of bismuth subnitrate (1 dram to the ounce—4.0 gm.–30.0 c.c.), or of from 3 to 4 ounces (90.0–120.0 c.c.) of a solution of tannin (1 per cent.). If the injection containing silver nitrate excite pain, the bowel should be flushed with salt solution.

Opium is often of the utmost value, but extreme caution must be exercised in its use. On the whole, it has undoubtedly caused more harm than good. In many cases there is absolutely no indication for it. It is called for when the diarrhea continues in spite of the thorough unloading of the bowel and the administration of mild astringents. One of the best preparations is paregoric; of this, from 3 to 5 minims (0.2–0.3 c.c.) may be given every two, three, or four hours according to circumstances. Opium should not be added to mixtures, but should be prescribed by itself. When the stomach is unreten-

tive, laudanum in doses of from 1 to 2 minims (0.06–0.1 c.c.) may be added to starch-water (½ ounce—15.0 c.c.) and administered by the rectum. In cholera infantum small doses of morphin (1/100 gr.—0.0006 gm.) with atropin (1/800 gr.—0.00008 gm.) may be given hypodermically.

Stimulants are often required. Whisky and brandy are perhaps the best. From 10 to 20 minims (0.6–1.2 c.c.) of one or the other may be given in cold water every two, three, or four hours. When the stomach is unretentive, it will be necessary to administer stimulants hypodermically. Hypodermoclysis also affords a valuable means of preventing exhaustion. In threatened collapse hot packs or hot baths may prove beneficial.

Fever, according to its intensity, should be controlled by cold sponging, cold packs, or cool baths (85°–75° F.—29.5°–24° C.). Intestinal irrigation with cool water may also be used for its antipyretic effect.

## CHRONIC DIARRHEA.

The first thing to do is to ascertain the cause and to remove this, if possible. The diet, clothing, habits, occupation, and mode of living of the patient should receive the most careful attention. No definite rules can be laid down in reference to the diet. Many patients do well upon an exclusive milk diet. Scraped beef, raw or underdone, is often well borne. In some cases it is an advantage to have the food peptonized. When the disease is not very severe and is confined for the most part to the colon, a selected mixed diet may be allowed. In such cases pulled bread or toast, tender beef or mutton, oysters, raw or boiled eggs, boiled rice, arrow-root, and plain custard are available. Foods that are bulky and leave much residue are always inadmissible.

Protection of the body against chilling is of vital importance. Woolens should be worn next to the skin. A snugly fitting abdominal bandage may be worn as an additional safeguard. Rest in bed is sometimes essential. The obstinate diarrhea occasionally encountered in hysterical women is often benefited by a modified rest cure. When the general nutrition is not too much impaired, a change of air and scene may prove very effectual.

The *medicinal treatment* of chronic diarrhea is very unsatisfactory. Mineral astringents, especially bismuth subnitrate (30–40 gr.—2.0–2.5 gm.), silver nitrate (¼–½ gr.—0.016–0.03 gm.), copper sulphate (¼–1 gr.—0.016–0.06 gm.), and lead

acetate (1–3 gr.—0.06–0.2 gm.), enjoy the most repute. These drugs should always be given a thorough trial, as even under the most favorable conditions improvement is slow in appearing. Intestinal antiseptics—salol, thymol, bismuth subsalicylate, creasote, betanaphthol-bismuth, and benzonaphthol—are useful adjuvants to astringents, especially when there is considerable intestinal fermentation. Opium in small amounts is often required, particularly in acute exacerbations. Wood has found the following tar-water mixture a most effective remedy in many cases:

℞ Picis liquidæ, ʒiij (90.0 c.c.);
Triturentur cum liquore calcis, Oviij (4.0 L.), ad saturationem, et percolentur per prunum virginianam, ℥viij (250.0 gm.). M.
Sig.—A wineglassful one to two hours after meals.

In the diarrhea of hysterical women strontium bromid is sometimes of value. Arsenic (see p. 310) has been highly recommended in that form of diarrhea characterized by an uncontrollable desire to evacuate the bowel immediately after taking food. In malarial cases a cure is generally rapidly effected with quinin. When there is decided anemia, tincture of ferric chlorid will be found serviceable. In many cases it is a good plan to resort to intestinal irrigation from time to time or to administer a purgative (castor oil, Epsom salts, or calomel) occasionally to remove from the bowel scybalous masses or viscid mucus.

When the disease is situated chiefly in the colon, local treatment is of the greatest service. Starch-water and laudanum enemata are sometimes useful. Generally, however, astringent injections are more successful. Irrigation of the bowel, two or three times a week, with a solution of silver nitrate (see p. 372) is especially to be recommended.

## DYSENTERY.

Rest in bed is imperative, even in chronic cases. In acute dysentery the diet should be liquid or semiliquid. Milk with lime-water, whey, milk-toast, animal broths, and egg-white may be given. Predigested foods are often very useful. In the chronic form of the disease it may be necessary to give a somewhat more liberal diet in order to maintain nutrition. Soft-boiled eggs, pulled bread, boiled rice, oysters, and tender meats (chicken, mutton, and beef) may be allowed. The intestinal discharges should be disinfected immediately as in the case of typhoid fever.

An unirritating purgative (castor oil, Epsom salts, or calomel) is nearly always indicated at the onset. After the bowel has been thoroughly emptied, opium may be given to check peristalsis and to relieve the tormina and tenesmus. It is best given hypodermically in the form of morphin or by the bowel in the form of starch-water and laudanum injections or opium suppositories (½–1 gr.—0.03–0.06 gm.). Hot fomentations, turpentine stupes, or sinapisms to the abdomen also afford relief. Persistent tenesmus may sometimes be controlled by iodoform suppositories (2–5 gr.—0.13–0.3 gm.). Wood speaks favorably of ice suppositories, inserted for a length of time, one after another.

Some benefit may be derived from the administration of bismuth subnitrate (20–30 gr.—1.3–2.0 gm.) by the mouth, combined with an antiseptic like salol or betanaphthol-bismuth. Sulphur is another remedy well worthy of trial in obstinate cases. Ten grains (0.65 gm.) should be given three or four times a day, combined with a small quantity of opium. In many cases the adynamia is so pronounced that stimulants must be used freely. In cases in which the typhoid state is well developed oil of turpentine, 5–10 minims (0.3–0.6 c.c.) in emulsion, often acts favorably.

After the most acute symptoms have subsided intestinal irrigation may be employed with the greatest benefit. The patient's hips should be elevated and the fluid should be introduced very gently and slowly by means of a fountain syringe. When the rectum is very irritable, it is advisable to inject a small quantity of cocain solution (4 per cent.) before introducing the irrigator. In acute dysentery normal salt solution at a temperature of 100°–103° F. (38°–39.5° C.) may be employed for the irrigation. Weak solutions of boric acid (½ dram to 1 quart—2.0 gm.–1.0 L.) and of potassium permanganate (2–5 grains to 1 quart—0.13–0.3 gm. to 1.0 L.) have also been recommended. Hare has used zinc sulphocarbolate (40 grains to 1 quart—2.6 gm. to 1.0 L.) with very satisfactory results. In amebic dysentery warm injections of quinin (from 1 : 5000 to 1 : 1000) have been found very efficacious. In chronic dysentery weak solutions of silver nitrate (10–30 grains to 1 pint—0.6–2.0 gm. to 0.5 L.) are generally the most useful (see p 372).

Three special methods of treatment merit consideration that by ipecac, that by salines, and that by antibacterial serum

Many practitioners who have had much experience in the treatment of dysentery in India have borne testimony to the value of ipecac. At the onset it is customary to give a large

dose (30 gr.—2.0 gm.), and this usually induces vomiting. After vomiting has occurred the drug is administered in smaller doses (2–5 gr.—0.13–0.3 gm.) at intervals of two hours. To insure the retention of the latter doses opium is generally given a short time in advance of the ipecac. A successful result is indicated by the appearance, usually within twelve hours, of a copious black stool. In the sporadic dysentery of temperate zones this treatment has not proved very satisfactory.

Magnesium sulphate is another remedy which has been brought prominently forward within the last few years, especially in India and other tropical countries. In 1900, Buchanan reported a series of 453 cases of dysentery treated by this drug in which there were but 5 deaths. A purgative dose is first administered, and after the bowel has been thoroughly emptied, smaller doses (1 dr.—4.0 gm.) are given three or four times a day, preferably in combination with aromatic sulphuric acid, as in the following formula:

℞ Magnesii sulphatis, ℥iss (45.0 gm.);
Acidi sulphurici aromatici, f℥ij (8.0 c.c.);
Aquæ cinnamomi, q. s. ad f℥vj (180.0 c.c.). M.
Sig.—Tablespoonful three or four times a day.

The treatment should be continued for several days after the stools have ceased to be dysenteric. Unlike the ipecac treatment, this plan not infrequently gives good results in the acute dysentery met with in temperate regions.

The discovery that one form of acute dysentery is caused by a special organism, the bacillus of Shiga, is sufficient ground for hope that a curative serum will be forthcoming. Indeed, Shiga claims to have reduced the mortality in a recent epidemic in Japan from 37 to 8 per cent. by means of an antibacterial serum.

## APPENDICITIS.

There is a considerable diversity of opinion among physicians and surgeons as to the best method of treating appendicitis. Some advise surgical intervention in all cases as soon as the diagnosis is made; others, among whom are the greater number of representative surgeons, advocate a policy of intelligent discrimination and selection.

The author is of the opinion that operation should be urged—(1) At once in all cases in which the onset is very severe, the symptoms indicating special severity being marked right-sided tenderness and rigidity, distention, and vomiting, with or without fever; (2) in cases of moderate severity which manifest no

improvement after the lapse of forty-eight hours; and (3) in cases in which the symptoms, after decided improvement, return. On the contrary, operation is rarely required, at least during the attack—(1) In cases of a mild type, in which the pain is unaccompanied by rigidity, distention, nausea, or vomiting; and (2) in cases of moderate severity in which improvement is noticeable within forty-eight hours. Operation during the quiescent stage, when the element of danger is almost entirely removed, is to be recommended—(1) When an acute attack has been followed by persistent tumefaction and tenderness, intestinal disturbances, or impairment of the general health; (2) when there have already been two attacks, even of moderate severity; and (3) when mild attacks occur with such frequency as to induce disability.

**Medical Treatment.**—The medical treatment of appendicitis is very simple. The patient should be kept in bed at absolute rest. The diet should be restricted to small quantities of bland liquids—milk, albumin-water, and broths. Purgatives, as a rule, should be avoided, although there is usually no objection to administering a mild saline aperient at the onset of the attack. Constipation is best relieved by enemata of warm water. Locally, cold or heat may be applied, according to the sensations of the patient. Applications should not be used which affect the integrity of the skin, as they render surgical intervention more difficult should it subsequently be required. If the pain be very severe, morphin may be administered hypodermically; only the minimum amount necessary to afford a measure of relief is to be used, however, as by obscuring the symptoms the drug prevents an accurate study of the progress of the case.

## CATARRHAL HEPATITIS.

Diet is of the first importance. Fatty, starchy, and saccharine foods should be avoided. Milk, buttermilk, broths, egg albumen, lean meats, oysters, toast, pulled bread, and well cooked cereals — wheat, rice, and oat-meal—are admissible. Water-drinking is distinctly beneficial. Alkaline mineral waters like Vals, Vichy, and Hathorn, are frequently of service. If constipation resists the action of these waters, daily evacuations should be secured by means of sodium phosphate, Carlsbad salts, Rochelle salts, or a sulphated water, like Hunyadi János or Friedrichshall.

Bismuth subnitrate and silver nitrate are often of value in relieving the primary gastroduodenal catarrh. Ammonium chlorid (10 gr.—0.65 gm.—thrice daily, after meals) is also use

ful. In obstinate cases, nitrohydrochloric acid, as originally recommended by Scott, may prove beneficial. Daily irrigation of the colon with from 1 to 2 quarts (1.0–2.0 L.) of cold water, as advocated by Krull, is sometimes followed by improvement.

*Intestinal fermentation and flatulence* may yield to inspissated ox-gall or to an antiseptic like salol, bismuth salicylate, or betanaphthol-bismuth. *Itching* should be treated with tepid alkaline baths and lotions of carbolic acid, boric acid, or diluted hydrocyanic acid. Internally bromids, in full doses, may be tried when the pruritus is severe.

## CHOLELITHIASIS.

**Medical Treatment.**—Gall-stones in the gall-bladder or in the biliary passages cannot be dissolved. Turpentine and ether (Durande's mixture), chloroform, sodium succinate, sodium choleate, sodium oleate, and a host of other drugs have been recommended with a view to their solvent effects, but they have been found wholly ineffectual. Attempts to accomplish the extrusion of calculi by means of drugs have proved equally futile. Probably not more than 5 per cent. of those who have gall-stones suffer any inconvenience from their presence (Kehr). When symptoms occur, they result, in the large majority of cases, from a coincident cholecystitis. As the latter is the chief factor in exciting the violent expulsive efforts which force the stones from the gall-bladder into the ducts, it is mainly responsible for the recurrent attacks of colic. As we have no solvents for gall-stones and no remedies capable of effecting their expulsion, our efforts must be directed to keeping the stones quiescent, and this can be accomplished only by allaying catarrhal inflammation of the gall-bladder and by guarding against its recurrence.

Diet and hygiene are of the utmost importance. The food should be plain and readily digestible. Saccharine matters, fat meats, and highly seasoned dishes are undesirable. With the view of promoting a more continuous flow of bile it is often advantageous, when the gastric digestion is well maintained, to give the food in small quantities at comparatively short intervals. A light meal at bedtime has been especially recommended by Kehr. Frequent feeding may prove very harmful, however, when there is slow digestion with atony of the stomach. Water-drinking between meals should be encouraged.

Regular exercise in the open air, provided the symptoms are latent, is extremely beneficial. Constriction of the upper part of the abdomen by corsets or other articles of dress is to be rigidly avoided. The practice of manipulating the gall-bladder

for the purpose of expelling calculi, which has been advocate by some, cannot be too strongly condemned.

Freedom from worry and mental effort, probably by con ducing to good digestion, often exerts a marked salutary effec

Digestive disturbances should receive appropriate treatmen Among drugs, alkalis and alkaline mineral waters are undoubt edly efficacious. Sodium bicarbonate or sodium phosphat may be taken well diluted in the morning an hour before break fast and also between meals. If there be decided constipatio a small quantity of Rochelle salt or sodium sulphate may b added to each potation. The natural mineral waters, notabl those of Carlsbad and Vichy, have acquired a high reputatio When there is a tendency to so-called bilious attacks, an oc casional course of calomel in fractional doses will be found c benefit. In similar cases irrigation of the bowel, once or twic a week, with from 1 to 2 quarts (1.0–2.0 L.) of cool water also very useful.

Finally, when there are no evidences of active inflammatic in the gall-bladder and the patient's circumstances will permi we may recommend a course of treatment at Carlsbad, Vich or Contrexéville, with some degree of confidence. An extende visit to one of these resorts is often followed by considerab improvement, and in rare cases by permanent relief. Th benefit from a stay at one of these spas probably depends mo upon change of air and scene, genial surroundings, regul hours, and freedom from worry than upon the waters then selves.

*Hepatic Colic.*—When the pain is violent it will be necessa to give morphin and atropin hypodermically at short interval As the opium habit is readily formed in these cases, it nee scarcely be added that great caution should be exercised in th use of the drug. Agonizing pain often yields very prompt to a few whiffs of chloroform. In the mild but rather persiste attacks a few doses of antipyrin in hot water may suffice. Th external application of heat is very useful. Hot poultices fomentations may be applied to the region of the liver, or, whe circumstances permit, the patient may be kept in a hot bat Exceptionally, an ice-bag affords more relief than any of th hot applications. When vomiting is urgent, carbonated wate cracked ice, or small quantities of champagne may be give In threatened collapse diffusible stimulants are needed.

*Acute Obstruction of the Common Duct.*—The measures be suited for promoting the advance of the stone into the bow are rest, regulation of diet, the free use of alkaline miner waters, the occasional exhibition of saline laxatives, and th

application of heat to the hypochondriac region. Olive oil (see p. 465) has been recommended as a special remedy, but it is of doubtful efficacy. As the sequelæ of impaction of the common duct are so numerous and so grave, surgical aid should be invoked if the obstruction is not removed under medical treatment within a period of two or three weeks.

**Surgical Treatment.**—Surgical intervention is called for—(1) When, despite medical treatment, attacks of colic occur so frequently and are of such severity as to cause disability or make the addiction to morphin a likelihood; (2) in persistent obstruction of the common duct; (3) in hydrops of the gall-bladder due to impaction or stricture of the cystic duct; and (4) in suppurative inflammation of the gall-bladder or gall-ducts.

In the hands of experienced operators the mortality of cholecystotomy in uncomplicated cases is very low, certainly not more than 1 or 2 per cent. The mortality of choledochotomy is higher, although in Kehr's last 137 cases it was only 6.5 per cent., and in a continuous series of 80 operations performed by Mayo Robson, it was less than 4 per cent.

After operation medical treatment should be continued on the lines already laid down for the management of cholelithiasis that is more or less latent, with the view of preventing the further formation of stones.

## CIRRHOSIS OF THE LIVER.

As cirrhosis of the liver is almost invariably associated with congestion of the stomach and gastric catarrh, these conditions are the first to demand attention. A diet of bland, readily digestible food is indicated. Alcohol should be forbidden. Tea, coffee, fatty matters, and highly spiced or seasoned dishes are inadmissible. Milk, eggs, oysters, sweetbread, tender meats, and well-cooked cereals may usually be allowed. In advanced cases an exclusive milk diet is advisable. As in simple gastric catarrh, such drugs as silver nitrate and bismuth subnitrate are sometimes of service. Lavage of the stomach should not be practised for fear of wounding the varicose veins at the lower end of the esophagus. Measures which promote the action of the skin and kidneys should not be neglected.

Portal congestion is best relieved by saline aperients and the occasional use of a mild mercurial. Mineral waters, such as those of Vichy, Carlsbad, Saratoga, Hunyadi János, and Friedrichshall, taken hot an hour before meals, often have an excellent effect.

Potassium iodid has been largely employed with the hope that it might favor the absorption of the overgrown connective tissue. While it is apparently useless in the absence of syphilis, in syphilitic cases it may prove very beneficial.

**Ascites.**—Effusion that is only moderate in amount can sometimes be removed by the administration of cathartics and diuretics. A concentrated solution of Epsom salts (½–1 oz.—15.0–30.0 gm.), taken in the morning before breakfast, is usually the most efficient purgative. Occasionally it may be desirable to substitute compound jalap powder or elaterium. The diuretics of approved value are potassium acetate or bitartrate, digitalis, and squills. The combination of blue-mass, digitalis and squills, known as Niemeyer's pill (see p. 52), has a well deserved reputation. Murchison and Fagge advocated resin of copaiba (15 gr.—1.0 gm., daily), but it often disturbs the stomach. The use of drugs should not be persisted in; if the ascites does not diminish in the course of a few days, it is far better to resort to paracentesis. The operation is readily performed, and if done under antiseptic precautions, is attended with but very slight risk. It not only affords speedy relief but, by removing the pressure from the abdominal veins, also assists the action of diuretics. Occasionally, after one or two tappings, the fluid does not return for a long period—perhaps several months or even years; generally, however, the abdomen quickly refills, so that frequent repetition of the operation becomes necessary.

The operation of *paracentesis abdominis* is performed as follows: The bladder having been emptied, the patient is placed in a semirecumbent position, and a spot in the median line midway between the umbilicus and the symphysis pubis is anesthetized by means of a block of ice sprinkled with salt. A stout trocar is now introduced with a quick thrust into the abdominal cavity, a rubber tube is attached to the cannula for the purpose of conveying the fluid into a pail placed below the patient's bed, and the trocar is then withdrawn. While the fluid is escaping a many-tailed bandage is adjusted to the abdomen and gradually tightened. The application of such a binder should never be omitted. It gives support to the relaxed abdominal walls, and tends to prevent syncope and hematemesis. When the fluid ceases to flow, the cannula is removed, and the opening sealed with an antiseptic pad and a few strips of adhesive plaster.

**Surgical Treatment.**—Talma's operation (suture of the omentum to the margin of an abdominal incision, and irritation of the peritoneal surface of the liver and spleen), or one of its

modifications, has proved of some benefit in a limited number of cases of liver cirrhosis with ascites. The object of the operation is to establish a compensatory circulation by making accidental adhesions and thus increasing the anastomoses between the vessels of the portal system and those of the systemic circulation. In 227 cases collected by Sinclair White (November, 1906) death from the operation occurred in 33 per cent., failure in 15 per cent., improvement in 13 per cent., and symptomatic cure in 37.3 per cent. The duration of the cure at the date of publication was between one and two years in 7 cases, between two and three years in 17 cases, and over three years in 5 cases. The operation is contraindicated when cardiac or renal disease coexists.

## DISEASES OF THE RESPIRATORY SYSTEM.

### ACUTE RHINITIS.

In mild attacks little treatment is required. If the constitutional symptoms be severe, it is advisable for the patient to remain in his room, or even in his bed. When the patient is seen at the outset and is willing to remain indoors for twenty-four hours, a hot foot-bath, with a full dose of Dover's powder, followed in the morning by a Seidlitz powder or another saline aperient, often gives excellent results. When the patient is fully able to go about, the following capsules will usually afford considerable relief:

℞ Pulveris camphoræ, gr. vj (0.4 gm.);
Extracti belladonnæ,
Codeinæ sulphatis, aa gr. iss (0.1 gm.);
Cinchoninæ sulphatis, gr. xij (0.8 gm.). M.
Pone in capsulas No. xij.
Sig.—One every two or three hours.

**Local treatment** is very useful. In the early stage, when there is marked swelling of the mucous membrane, the application of cocain (2–4 per cent. solution) is sometimes exceedingly efficacious. If, however, no lasting effect is secured after three or four trials, its use should be discontinued. Warm Dobell's solution (see p. 172) or warm distilled extract of witch-hazel (diluted with 1 part of water), used as a spray at intervals, and followed in a few minutes by an oily application like the following, generally renders satisfactory service:

℞ Mentholis, gr. iij (0.2 gm.);
Olei pini pumilionis, ♏ v (0.3 c.c.);
Petrolati liquidi, q. s. ad f℥j (30.0 c.c.). M.

Among numerous vapor-inhalations recommended for their soothing effect the following are worthy of mention: Compound tincture of benzoin, 1 dram (4.0 c.c.), and hot water, 1 pint (0.56 L.); chloroform, 1 dram (4.0 c.c), and hot water, 1 pint (0.5 L.); iodin, 1 or 2 grains (0.06–0.13 gm.), and ether, 1 ounce (30.0 c.c.); camphor, 1 dram (4.0 gm.), and hot water, 4 ounces (120.0 c.c.).

## CHRONIC RHINITIS.

The treatment of chronic rhinitis is both general and local. It is highly important to ascertain the existence of any constitutional vice and to remove this if possible. Attention to hygienic conditions is most essential. Fresh air, out-door exercise, and frequent bathing, followed by friction of the skin are to be insisted upon. Tonics, especially strychnin and cod liver oil, are often required.

When the disease is not far advanced, much can be accomplished by keeping the nasal passages thoroughly clean. For this purpose detergent alkaline fluids may be applied by means of a coarse spray or the nasal douche-cup. A large number of combinations have been suggested, of which Dobell's solution (see p. 172) and the following are good examples:

| | | |
|---|---|---|
| ℞ | Sodii bicarbonatis, | |
| | Sodii boratis, | aa gr. xxx (2.0 gm.); |
| | Sodii chloridi, | gr. iij (0.2 gm.); |
| | Thymolis, | |
| | Mentholis, | aa gr. ss (0.03 gm.); |
| | Olei gaultheriæ, | ♏ij (0.12 c.c.); |
| | Glycerini, | f℥ij (8.0 c.c.); |
| | Alcoholis, | f℥ss (2.0 c.c.); |
| | Aquæ, | q. s. ad f℥viij (240.0 c.c.). M. |

In the early stage, when the redundant tissue is not very dense, local remedies of an astringent or alterative character are often very efficacious. The following applications are in common use: A mixture of iodin and glycerin containing 4 grains (0.4 gm.) of iodin, 12 grains (0.8 gm.) of potassium iodid, and 1 ounce (30.0 c.c.) each of glycerin and water; aqueous solution of ichthyol (20–40 per cent.); solution of zinc sulphocarbolate (2–5 per cent.); solution of resorcin (1 per cent.); and solution of silver nitrate (1–2 per cent.).

When the hypertrophic process has progressed so far that these simple measures prove ineffective, a more energetic treatment is demanded. The obstruction must be removed by means of caustics (chromic acid, trichloracetic acid, and acetic acid), the galvanocautery, or the snare, the proper use of which usually requires the services of a skilled specialist.

**Atrophic Rhinitis (Ozena).**—Improvement in the general health by the aid of fresh air, good food, and of such remedies as cod-liver oil, iron, arsenic, and strychnin is often requisite. If any syphilitic taint is suspected, potassium iodid and mercury should have a fair trial. Subcutaneous injections of antidiphtheritic serum have been used in a number of instances with alleged good results, this treatment having been tried in consequence of the assertion made by Belfanti and Della Vedova, and confirmed by other observers, that a bacillus identical with the bacillus of diphtheria is the cause of ozena.

The first requisite of local treatment is thorough cleanliness of the nasal passages, and to secure this the patient should be directed to spray the nose two or three times a day with Dobell's solution or some other mild detergent fluid. When the crusts are difficult to remove, they may be softened by pledgets of cotton soaked in a solution of hydrogen dioxid. After the nares have been cleansed, an oily solution like the following may be used to moisten and protect the parts:

| | | |
|---|---|---|
| ℞ | Mentholis, | gr. xx (1.3 gm.); |
| | Thymolis, | gr. vj (0.4 gm.); |
| | Eucalyptolis, | ♏xx (1.2 c.c.); |
| | Petrolati liquidi, | f℥vj (180.0 c.c.). M. |

Among the many local remedies which have been employed for their stimulant effects ichthyol is perhaps the best (see p. 335). When there is much secretion, insufflations of zinc stearate (75 per cent. with boric acid), as recommended by C. C. Rice, are sometimes useful.

Interstitial electrolysis has been used by some observers with considerable success. The *modus operandi* of this method of treatment is as follows: The nasal fossæ having been cleansed and anesthesia having been produced by means of a 10 per cent. solution of cocain, a copper needle attached to the positive pole is introduced beneath the mucous membrane of the middle turbinated body, and a platinum needle attached to the negative pole is introduced into the lower part of the septum or into the outer wall of the inferior meatus of the same nostril. The intensity of the current employed has varied from 6 to 15 milliampères, and the duration of the sittings from ten to fifteen minutes.

For destroying the offensive odor a large number of drugs have been suggested, of which the following may be mentioned: Citric acid (see p. 469), formalin (1 : 1000 to 1 : 500), Labarraque's solution (1 : 30), potassium permanganate (2 grains to the ounce—0.13 gm.–30.0 c.c.), and creolin (1 : 100).

## ACUTE LARYNGITIS.

In severe cases the patient should be confined to bed, and the temperature of the room kept uniformly at 70°–72° F. (21°–22° C.). The air should be rendered moist by means of steam. A hot foot-bath at the onset is often beneficial. The use of the voice should be avoided as much as possible. The external application to the throat of cold compresses or of an ice-bag is of service. In grave forms of the disease it may be advisable to apply a few leeches to the upper part of the sternum.

Warm inhalations afford considerable relief. A dram (4.0 c.c.) of compound tincture of benzoin, half a dram (2.0 c.c.) of oil of turpentine, or half a dram (2.0 c.c.) of oil of cubebs may be added to a pint (0.5 L.) of boiling water and the fumes inhaled. For want of a special apparatus for the administration of these inhalations steam may be collected and conducted by means of an ordinary tin funnel which has been inverted over a bowl containing the medicated hot water. In vaporizing oily substances it is advisable to mix them first with magnesium carbonate in order to aid their suspension in the water.

In the early stage direct local applications are rarely required; later in the disease, however, the application of astringents by means of the atomizer often proves useful. Alum, 5–10 gr. (0.3–0.6 gm.) to the ounce (30.0 c.c.); silver nitrate (1–2 per cent. solution) and zinc sulphate, 2–3 gr. (0.13–0.2 gm.) to the ounce (30.0 c.c.), often give satisfactory results when used in this manner.

Internal medication may do much good. At the onset of the disease it is usually advisable to administer a saline purge. If the cough be troublesome, a sedative, like Dover's powder, codein, or heroin, may be given in conjunction with a mild expectorant, such as ipecac, potassium citrate, or ammonium chlorid.

In acute *edematous laryngitis*, when the swelling does not yield promptly to local bloodletting, the external application of ice, astringent sprays, scarification of the mucous membrane, and active catharsis, tracheotomy should be performed without delay.

**Spasmodic Croup.**—The indications are to arrest the paroxysms and to prevent their recurrence. When the paroxysms are severe, the child may be placed in a warm bath (100° F.—38° C.) for ten or fifteen minutes, or an emetic (ipecac or alum) may be given instead. Occasionally the dyspnea is so intense as to demand the inhalation of a few drops of chloro-

form or amyl nitrite. Mild attacks usually yield to the application, over the larynx, of a sponge wrung out of hot water.

The remedial measures which have been advocated for simple laryngitis are also of service in preventing attacks of pseudo-croup. Such a combination as the following will generally be found useful:

℞ Tincturæ aconiti, ℥vj (0.4 c.c.);
Vini ipecacuanhæ, f℥j (4.0 c.c.);
Potassii bromidi, ℥ss (2.0 gm.);
Potassii citratis, ℥j (4.0 gm.);
Syrupi tolutani, f℥j (30.0 c.c.);
Aquæ, q. s. ad f℥ij (60.0 c.c.). M.

Sig.—A teaspoonful every two or three hours for a child of eighteen months.

## CHRONIC LARYNGITIS.

It is highly important to determine in each case the underlying cause of the local irritation, and to remove this if possible. Injurious habits, such as the excessive use of tobacco or alcohol, must be corrected. The diet, exercise, bathing, and clothing must be carefully regulated. While it is essential that the body should be warmly clad, the practice of wearing thick scarfs about the neck as a means of protection from cold should be condemned. Daily sponging the neck and chest with cool water is a far better way of guarding against recurrent attacks of inflammation. In some cases a change of occupation is imperative. Rest of the voice is always indicated. Not infrequently improper or excessive use of the voice is the main etiologic factor, and when this is the case permanent relief can be secured only by the correction of the error. As in a large group of cases a morbid process in the nasopharyngeal passages is the sole cause of the laryngeal irritation, it follows that the removal of this primary disease must often be the fundamental principle in the treatment. Any constitutional disease, such as rheumatism or gout, or any derangement of the digestion or circulation that may be present should receive careful attention. Change of scene and climate is often of the greatest benefit, a warm, dry climate being especially favorable to the condition.

In many cases of chronic laryngitis tonics, like iron, strychnin, and cod-liver oil, are efficacious. Even when there is no evidence of syphilis, potassium iodid in small doses is sometimes useful, especially when there is a great lack of secretion with a tendency to the formation of crusts. Expectorants have little, if any, effect upon the chronic process, but often prove serviceable in acute exacerbations.

*Local treatment* is of prime importance. Remedies are best applied by means of sprays or a camel's-hair brush or cotton swab. Lozenges are also of benefit in certain conditions. Vapor inhalations and insufflations of dry powders are not so satisfactory. Thorough cleanliness, not only of the larynx itself, but also of the nose and pharynx, is always requisite. This is best secured by spraying the parts at frequent intervals with a mild alkaline solution. If there be deficient secretion, one of the following solutions may be employed as a spray after the mucous membrane has been cleansed: Sodium chlorid, 5 gr. (0.3 gm.) to the ounce (30.0 c.c.); potassium chlorate, 5 gr. (0.3 gm.) to the ounce (30.0 c.c.); ammonium chlorid, 5 gr. (0.3 gm.) to the ounce (30.0 c.c.); or potassium iodid, 5 gr. (0.3 gm.) to the ounce (30.0 c.c.). Lozenges containing 1 or 2 gr. (0.6–0.13 gm.) of ammonium chlorid may also afford relief, especially if the pharynx be much affected. When there is excessive secretion, astringent sprays are indicated, and one of the following may be selected: Alum, 3–5 gr. (0.2–0.3 gm.) to the ounce (30.0 c.c.); zinc acetate, 3–5 gr. (0.2–0.3 gm.) to the ounce (30.0 c.c.); zinc sulphocarbolate, 2–3 gr. (0.13–0.2 gm.) to the ounce (30.0 c.c.); or lead acetate, 1–3 gr. (0.06–0.2 gm.) to the ounce (30.0 c.c.). When more active astringents are required, they should be applied directly to the larynx by means of a cotton swab or camel's-hair brush. Thus, benefit may be derived from a solution of tannin, 10 gr. (0.6 gm.) to the ounce (30.0 c.c.) of glycerin, or from a solution of silver nitrate, 5–10 gr. (0.3–0.6 gm.) to the ounce (30.0 c.c.) of water. Actual abrasions may be touched with a strong solution of silver nitrate, 40–60 gr. (2.6–4.0 gm.) to the ounce (30.0 c.c.). When there is scab-formation, a 20 per cent. solution of ichthyol often proves useful. Large varicose vessels should be cauterized (chromic acid) under cocain anesthesia.

**Tuberculous Laryngitis.**—Hygienic, climatic, dietetic and general medicinal treatment should be that of pulmonary tuberculosis (see p. 592). In the early stage medicated inhalations and sprays are of benefit. Such remedies as creasote, terebene, compound tincture of benzoin, and eucalypto may be used in a respirator or inhaled from the surface of boiling water. As a rule, sprays are more satisfactory. After the mucous membrane has been thoroughly cleansed with an alkaline detergent spray, one of the following sprays may be used: Corrosive sublimate (1 : 5000 to 1 : 4000), resorcin (1–2 per cent.), formalin (1 : 1000), or menthol (1–2 per cent.).

In tuberculous ulceration the treatment may be radical or

palliative. Unfortunately, the latter is the only form of treatment that is applicable in the large majority of cases. When, however, the disease in the lung is not far advanced and the ulceration in the larynx is circumscribed and readily accessible, the thorough removal of the diseased tissue may be attempted. The most approved method of radical treatment consists in the rubbing-in of lactic acid after the ulcer has been thoroughly cureted. If the ulcer be quite superficial, the curetment may be omitted. The parts must be carefully anesthetized with cocain (20 per cent. solution), and the acid applied in the proportion of 30, 50, or 75 per cent. solution, or even stronger, according to the effects. Ichthyol (undiluted) and guaiacol (undiluted) have been used in some cases instead of lactic acid.

When the ulceration is more diffuse and is associated with considerable infiltration, better results may be obtained from one of the following applications: Carbolic acid, ½–1 dram (2.0–4.0 c.c.) to the ounce (30.0 c.c.) of glycerin; tannin, 1 dram (4.0 gm.) to the ounce (30.0 c.c.) of glycerin; formalin (1–10 per cent. in glycerin); or chromic acid (2–3 per cent.).

In the advanced stages of the disease only sedative applications to relieve pain and dysphagia are justifiable. Among the agents most generally useful as insufflations may be mentioned orthoform, iodoform, cocain, and morphin. Semon recommends iodoform (1 gr.—0.06 gm.), boric acid (1 gr.—0.06 gm.), and morphin sulphate (⅛ gr.—0.01 gm.). Fasano speaks highly of the following combination: Thiocol, 1; cocain, 2; boric acid, 10. A 5–10 per cent. solution of menthol in liquid petrolatum used as a spray often affords much relief. Intratracheal injections have also been recommended. Vacher has had excellent results from injections of 30 minims (2.0 c.c.) of the following: Guaiacol, 5 parts; eucalyptol, 2 parts; menthol, 1 part; and saturated solution of iodoform in ether, 100 parts. When dysphagia is very severe, it may be well to apply cocain to the larynx before eating, using a 2–4 per cent. solution as a spray or a 5–10 per cent. solution as a direct application. When deglutition is extremely painful, Wolfenden suggests that the patient take liquid food while lying prone, the head hanging over the edge of a couch, and the nourishment being sucked through rubber tubing from a bowl on the floor.

**Syphilitic Laryngitis.**—Constitutional treatment with iodids and mercurials is of the first importance. Local cleanliness should be secured by thorough spraying with some alkaline antiseptic solution. Ulcers may be touched with

silver nitrate (melted on a silver probe), acid nitrate of mercury (1 to 5 parts of water), or chromic acid (1 to 8 parts of water). Insufflations of iodoform are also useful. Cicatricial stenosis may call for gradual dilatation or even tracheotomy.

## ACUTE BRONCHITIS.

If the patient be weak or old, he should be confined to his room or even to bed; the atmosphere of the room should be kept warm and moist. If the patient be seen at the outset, it is useful to promote free diaphoresis, and this may be accomplished by means of a hot foot-bath, with hot drinks and a full dose of Dover's powder. Warm inhalations, such as have been suggested in acute laryngitis (see p. 580), are also of service. Counterirritation to the chest in the form of sinapisms or stupes is very beneficial. When there is much dyspnea, as there frequently is when acute bronchitis complicates emphysema, the application of dry cups, or even of a few wet cups, to the chest often has a marked salutary effect. The food should be simple and readily digestible, and the bowels should be kept regularly open by the aid of mild aperients.

Distressing dry cough is usually best controlled by one of the opium derivatives—codein or heroin—and fever by aconite with spirit of nitrous ether or by small doses of phenacetin. When for any reason opium is objectionable, hyoscyamus, spirit of chloroform, sodium bromid, or diluted hydrocyanic acid may be used instead. When the cough remains persistently dry sedative expectorants may be given to favor secretion. For this purpose potassium citrate, ipecac, apomorphin, and antimony are extensively employed. The combination of potassium citrate and ipecac given on page 271 is especially useful in this stage of the disease. In young, robust persons antimony is decidedly efficacious, and may be prescribed according to the formula suggested on page 272.

When the bronchial secretion becomes more abundant, stimulant expectorants are indicated. Ammonium chlorid is one of the most reliable members of this class; it may be prescribed in some simple vehicle, like brown mixture, or with squill, as in the formula given on page 276. Expectorants of an oily nature, such as terebene, oil of eucalyptus, oil of santal, and oil of copaiba are also very efficacious, but more liable than the ammonium salt to derange digestion. Such a combination as the following is often very serviceable when the catarrh tends to become subacute:

℞ Terebeni,
Olei eucalypti, āā f℥ss (2.0 c.c.);
Strychninæ sulphatis, gr. $\frac{1}{30}$ (0.02 gm.);
Codeinæ sulphatis, gr. ii–iij (0.13–0.2 gm). **M.**
Pone in capsulas No. xij.
Sig.—One every four hours.

When the expectoration is purulent and heavy, a creasote derivative, like guaiacol carbonate, may be used with great advantage (for formula, see p. 287).

In the aged and infirm alcoholic stimulants are often required to combat general adynamia. Strychnin is a most valuable adjunct to the expectorants when there are indications that the heart is becoming strained by the violent paroxysms of cough. Should there be evidence of pronounced cardiac failure, it will be necessary to employ digitalis.

Such tonics as cod-liver oil, iodid of iron, quinin, and arsenic are often useful during convalescence from severe and prolonged attacks. Much benefit will also be obtained from suitable change of climate.

## CHRONIC BRONCHITIS.

To meet with any measure of success, treatment must be directed largely toward the prevention of recurrent attacks, and the removal, if possible, of the underlying cause. Indiscriminate routine treatment is to be rigidly avoided. Change of climate, especially in winter, is most beneficial, and should be urged if the circumstances of the patient will permit. When there is much bronchial secretion, a dry, warm climate, such as that of New Mexico or Southern California, in this country, and that of Egypt or the Riviera abroad, is generally to be recommended, whereas if there be little expectoration, a moist warm climate, such as that of Florida, the West Indies, Madeira, Pau, or Algiers, is preferable. When patients are unable to avail themselves of the benefits to be derived from a suitable climate, they should remain indoors as much as possible in bad weather, and take every precaution against exposure. Flannel should at all times be worn next to the skin, the feet should be kept perfectly dry, and the night-air should be avoided.

The diet should be simple but nutritious. In many cases alcohol in some form acts beneficially.

Underlying chronic diseases should always receive appropriate treatment. When cardiac insufficiency is present, digitalis, strychnin, or caffein may be required. When there is anemia with general malnutrition, such remedies as iron, arsenic, cod-liver oil, and hypophosphites may be given with advantage. When gout is a factor, benefit may be expected from the ad-

ministration of potassium iodid and alkalis. When renal inadequacy is coexistent, the diet must be very carefully supervised, and such measures adopted as will promote the functional activity of the various emunctories.

The *direct remedies* most generally useful are the expectorants of a terebinthinate or balsamic character, such as terebene, oil of eucalyptus, myrtol, oil of santal, oil of copaiba, and oil of cubeb. Tar is another remedy of value. It may be used in substance made into pills, or in the form of tar-water or the wine of tar. When the sputum is heavy and purulent, no drug acts so well as creasote or the carbonate of guaiacol. Potassium iodid is of service in some cases, but it is difficult to state definitely the exact conditions under which it is likely to prove beneficial. It may be tried tentatively when the expectoration is very scanty and viscid, or when there is evidence of a gouty diathesis. In acute exacerbations recourse must be had to such expectorants as potassium citrate, ipecac, antimony, apomorphin, and ammonium chlorid.

When the cough is much in excess of what is required to expel the exudation, mild anodynes, like codein or heroin, may be used from time to time to keep it in subjection. Alkalis (sodium bicarbonate, aromatic spirit of ammonia), with or without a few minims of the spirit of chloroform, taken in hot water before rising, will often lessen morning cough and facilitate expectoration. Dry cough may be largely the result of habit, and if this be the case much can be accomplished by discipline.

The following formulæ will serve to illustrate the manner in which the various remedies may be combined:

℞ Terebeni,
Olei eucalypti,
Olei santali, aa ʒi–ʒiss (4.0–6.0 c.c.);
Codeinæ, gr. iij–vj (0.2–0.4 gm.).
Misce et pone in capsulas No. xxiv.
Sig.—One after each meal and at bedtime.

℞ Terpini hydratis, ʒj (4.0 gm.);
Guaiacolis carbonatis, ʒij (8.0 gr.);
Strychninæ sulphatis, gr. ss (0.03 gm.);
Codeinæ, gr. iij (0.2 gm.).
Misce et pone in capsulas No. xxiv.
Sig.—One or two capsules three or four times a day.

℞ Apomorphinæ hydrochloridi, gr. ss (0.03 gm.);
Syrupi pruni Virginianæ, fʒij (60.0 c.c.);
Syrupi picis liquidæ, fʒiv (120.0 c.c.). M.
Sig.—A tablespoonful thrice daily. (Murrell.)

*Inhalations* are sometimes efficacious, especially when the disease appears to be situated chiefly in the trachea and larger bronchi. The volatile agent may be used in a special steam nebulizer, or preferably, if the patient must be about, in an oro-nasal respirator. The most suitable drugs for inhalation are terebene, eucalyptol, oil of Scotch fir, creasote, carbolic acid, iodin, compound tincture of benzoin, and spirit of chloroform. A number of these remedies may often be combined with advantage, as in the following formula:

℞ Chloroformi, ʒss–ʒj (2.0–4.0 c.c.);
Creosoti,
Terebeni,
Olei pini sylvestris, aa ʒiss (6.0 c.c.);
Alcoholis, q. s. ad ʒj (30.0 c.c.).

Sig.—From 5 to 20 drops to be used in the inhaler several times a day.

*Intratracheal injections* have given good results in certain instances. From 1–3 fl. dr. (4.0–11.0 c.c.) of a 1 per cent. solution of creasote or guaiacol, or of a 2 per cent. solution of menthol in olive oil may be injected between the vocal cords into the trachea once a day, a syringe with a long curved cannula being used for the purpose. The fluid should be injected in three or four separate portions, while the patient takes a slow, full inspiration.

*Inhalation of compressed air* by means of Waldenburg's apparatus, the pneumatic cabinet, or a pneumatic chamber like that in use at Brompton Hospital, affords considerable relief in some cases. According to Oertel, the good effects of the compressed air are to be attributed to the increased pressure within the bronchi, causing a diminution of the hyperemia, and, consequently, less exudation of serum into the bronchial walls and less pressure on the lymphatic system.

*Counterirritation*, preferably with iodin or small blisters, is often of great service in lessening the severity of acute exacerbations.

## ASTHMA.

The cause must be sought for in every case, and removed if possible. When the source of the reflex irritation is in the nasal passages, local treatment may be followed by marked improvement, or even cure. In a certain number of cases the source of the primary irritation is in the stomach, consequently digestive disturbances should always receive careful attention. Chronic bronchitis, emphysema, and dilatation of the heart are frequent concomitants of asthma and call for special treatment.

A general toxemia, such as occurs in gout, may be responsible for the attacks, and if this be the case appropriate measures must be employed to remove or control it. Unfortunately, in the majority of cases the chief etiologic factor appears to be a peculiar hyperesthesia of the bronchial mucosa, a morbid condition which at present we have no very potent means of combating.

Although we are unable fully to meet the causal indication in many instances, nevertheless much can often be done by well-directed hygienic measures and empiric medication to lessen the frequency and severity of the paroxysms. The diet should consist of plain, readily digestible food. A light evening meal is advisable, especially when the paroxysms tend to occur at night. Vicissitudes of temperature must be carefully guarded against and flannel always worn next to the skin. Much benefit is often derived from systematic exercise in the open air and from hydrotherapy, judiciously employed.

In delicate, poorly nourished subjects the administration of iron, cod-liver oil, hypophosphites, and other tonics does much good. A change of climate, even though slight, generally proves of decided service, but the choice of locality must be determined very largely by the personal experience of the patient. Many sufferers do better in the smoky atmosphere of cities than in the country. Asthmatics with moist bronchial catarrh usually do well in a dry, warm climate, while those with dry catarrh generally derive more benefit from an atmosphere that is somewhat humid (see p. 585). Elevated regions are mostly unsuitable for old persons with emphysema, but in young adults they may prove very advantageous. The inhalation of compressed air has been highly recommended by Bertin, Sandahl, Theodore Williams, and others. If employed, it is best carried out by means of the pneumatic cabinet or the "air-bath." The inhalation of oxygen has also been advocated.

Among special remedies potassium iodid holds the first place. While it often fails entirely, it undoubtedly possesses more power in averting attacks than any other drug. To be effective, it must be given in doses of from 5–20 gr. (0.3–1.3 gm.) three times a day for long periods. Sodium or strontium iodid is sometimes better borne by the stomach than the potassium salt. Tincture of belladonna, in doses of 3–5 min. (0.2–0.3 c.c.), thrice daily, is a valuable adjunct to the iodid. Arsenic has long been esteemed as a potent remedy, and may be tried when iodids prove of no avail. Grindelia robusta (see p. 283) is sometimes useful when there is much bronchial catarrh. Strychnin is of service in cases associated with em-

physema. Occasionally the prolonged administration of bromids, by allaying the nervous erethism, seems to increase the interval between the attacks. Nitroglycerin has also been highly extolled by some writers, but its action is uncertain and equivocal. VonNoorden has recently recommended the use of atropin, giving first a daily dose of $\frac{1}{120}$ gr. (0.0005 gm.) and cautiously increasing this until $\frac{1}{16}$ gr. (0.004 gm.) is given daily, and then gradually diminishing the dose. He repeats such a course of treatment every few months, using less of the drug each period.

**The Attack.**—The most suitable remedy for a particular case can only be determined by trial. A drug or a combination of drugs that succeeds admirably in one case may fail utterly in another. As a rule, drugs which are taken by inhalation give the most speedy relief. Some patients derive great benefit from the fumes of ignited stramonium or belladonna leaves or paper which has been impregnated with potassium nitrate. These agents may be burnt in the patient's room or smoked in a pipe or in the form of cigarets. Occasionally tobacco proves very efficacious. Marked alleviation of the paroxysms is often obtained from the inhalation of amyl nitrite (5–6 min.—0.3–0.4 c.c.) or ethyl iodid (10–20 min.—0.6–1.2 c.c.). In some cases the paroxysms yield readily to a few whiffs of chloroform, though generally the effects of the drug are only temporary.

When there is decided turgescence of the nasal mucosa, such as occurs in the asthma of autumnal catarrh, the topical use of adrenalin solution (1 : 5000), applied on a pledget of cotton or as a spray, will be found very effective. If such measures fail to afford relief, internal remedies must be used. In some cases strong hot coffee acts most happily; in others more benefit is derived from hot whisky and water. Among the numerous special remedies which have been advocated the following appear to be the most reliable: opium, belladonna, bromids, chloral, paraldehyd, Hoffmann's anodyne, lobelia, and quebracho.

Few attacks will resist the action of morphin hypodermically with atropin, but the greatest caution must be exercised in order that the patient may not become addicted to the drug. Heroin hydrochlorid hypodermically in doses of from $\frac{1}{12}$ to $\frac{1}{10}$ gr. (0.005–0.006 gm.) may often be substituted for morphin with great advantage. When the attacks are associated with bronchial catarrh a combination like the one suggested on page 283, or the following, will be found of value:

℞ Tincturæ belladonnæ, ʒj (4.0 c.c.);
Tincturæ lobeliæ, ʒiij (11.0 c.c.);
Fluidextracti aspidospermatis, ʒss (15.0 c.c.);
Spiritus ætheris compositi, ʒv (18.5 c.c.);
Strontii bromidi, ʒijss (10.0 gm.);
Elixiris aromatici, q. s. ad ʒiv (120.0 c.c.). M.
Sig.—A dessertspoonful in water every two or three hours.

Among other measures that have been found useful in alleviating asthmatic attacks may be mentioned the application of sinapisms to the chest, the inhalation of compressed air, and the inhalation of oxygen.

## EMPHYSEMA.

The treatment of emphysema is chiefly that of the accompanying disease. The various means suggested for the cure or relief of chronic bronchitis (see p. 585) may often be used here with great advantage. When asthma is the primary disease, treatment calculated to lessen the frequency and severity of the paroxysms should be instituted (see p. 587).

When fully established, emphysema is incurable, although it is susceptible to alleviation. Violent exercises and overexertion of all kinds must be proscribed. A diet that is light but sustaining is indicated. All foods likely to induce flatulence should be avoided. Much benefit is often derived from a change of climate, the choice of locality, however, depending somewhat upon the character of the complicating bronchitis (see p. 585). As a rule, high elevations are to be avoided.

The inhalation of compressed air by means of the pneumatic cabinet or the "air-bath" is usually followed by a marked improvement in the symptoms. The inspiration of compressed air with expiration into rarefied air has been especially advocated. Strümpell speaks favorably of rhythmic compression of the lower portion of the thorax during expiration, as recommended by Gerhardt. This should be done systematically by another person two or three times a day during fifty or sixty respirations.

General tonics, like iron and cod-liver oil, are required in some cases to improve the general health. Strychnin, being both a respiratory and a cardiac stimulant as well as a general tonic, is particularly useful. Digitalis will be found a serviceable remedy when signs of cardiac insufficiency appear. Ammonium carbonate, in conjunction with strychnin and digitalis, usually has an excellent effect upon acute exacerbations of the bronchial catarrh. At such time sinapisms applied to the chest may also afford considerable relief. When sleep is disturbed

by troublesome cough and oppressive dyspnea no drug is so generally useful as heroin. When the breathing is very difficult, the face suffused and livid, and the pulmonary circulation much impeded, recourse should be had to bloodletting, either local or general, according to the urgency of the symptoms.

## CATARRHAL PNEUMONIA.

Hygienic treatment is of the utmost importance. The atmosphere of the sick-room should be kept at an even temperature of 68°–70° F. (20°–21° C.), and should be rendered moist with steam. The diet should be liquid and nutritious. Milk, light broths, gruels, egg-white, and junket are suitable forms of nourishment. Alcoholic stimulants are often required. When the circulatory depression is pronounced, whisky or brandy may be given in doses of from 10 to 30 min. (0.6–2.0 c.c.) in milk to a child of two years every two or three hours.

At the outset it is often advantageous to administer a mild purgative, preferably calomel or castor oil. In the absence of any special indication for local treatment it will only be necessary to provide ample protection for the chest. This may be done satisfactorily by means of the jacket of cotton-wool. When there is harsh, dry cough, mild rubefaction produced by the application of the tincture of iodin of suitable strength generally affords some relief. In adults sinapisms or stupes may be used instead of the iodin..

Fever is best controlled by outward applications. Compresses wrung out of cold water may be wrapped around the chest and changed for fresh ones at intervals of from twenty to thirty minutes. This treatment not only serves to lower temperature, but it also affects very favorably the pulse and respiration, and conduces to sleep. When the fever is high recourse should be had to cold packs or cold baths (85°–80° F.—29.5°–26.5° C.).

Expectorants are almost invariably required. In the early stage, when the cough is harassing and the sputum viscid, potassium citrate is very serviceable. It may often be combined advantageously with spirit of nitrous ether and solution of ammonium acetate, as in the following formula:

℞ Potassii citratis, ʒiss (6.0 gm.);
Spiritus ætheris nitrosi, fʒvj (22.5 c.c.);
Liquoris ammonii acetatis, fʒj (30.0 c.c.);
Syrupi tolutani,
Aquæ, aa q. s. ad fʒiv (120.0 c.c.). M.
Sig.—Dessertspoonful every three hours for a child of three years.

Later, the ammonium salts, especially the carbonate, are more efficacious. From 1 to 2 gr. (0.06–0.13 gm.) of the latter may be given every three or four hours to a child of two years. Ammonium iodid is also useful in facilitating expectoration, and may be employed as an adjuvant, as in the following formula:

℞ Ammonii carbonatis, gr. xlviij (3.1 gm.);
Ammonii iodidi, gr. xxiv (1.5 gm.);
Syrupi tolutani,
Syrupi acaciæ, aa q. s. ad f℥iij (90.0 c.c.). M.
Sig.—Teaspoonful every two or three hours for a child of three years.

In adults the author has found creasote carbonate to be a reliable expectorant. When the bronchial secretion is very abundant belladonna is a valuable remedy. To a child of two years a min. (0.06 c.c.) of the tincture may be given every hour or two until the desired effect is produced. When the child is unable to expel the accumulated mucus and the breathing becomes much oppressed, an emetic (ipecac, alum, or zinc sulphate) will generally prove of great service. Inhalations of oxygen sometimes lessen cyanosis and make the breathing easier. Strychnin is also of benefit at this time in combating respiratory failure. When these measures fail to afford relief alternate douches of hot and cold water should always be tried since by provoking violent respiratory efforts they may serve to dislodge the retained secretion and to bring about a thorough inflation of the lungs.

If the symptoms of cardiac failure are especially pronounced digitalis must be given in addition to alcohol and strychnin. Extreme restlessness and insomnia will sometimes require the use of the bromids or some other mild sedative.

Except at the onset, when their administration may be necessary to relieve pleuritic pain and to control harassing cough opiates should not be used.

## PULMONARY TUBERCULOSIS.

**Prophylaxis.**—Efforts intended to prevent the extension of tuberculosis should be made in two directions, that of checking the dissemination of the bacillus, and that of rendering the tissues of the individual less susceptible to infection.

*The Bacillus.*—As the sputum of consumptive patients is the chief source of the bacillus, the disposition of this secretion becomes of the utmost importance. Such patients should be impressed with the danger, both to themselves and others

of indiscriminate spitting, and should be taught never to expectorate except in a proper receptacle. To be suitable, the spittoon should be provided with a closely fitting cover, and should be of such construction that it can be readily cleansed and disinfected. It should contain at all times some disinfectant fluid, such as a 5 per cent. solution of carbolic acid, and should be thoroughly scalded with boiling water at least twice a day. A very good cuspidor, and one that can be burned when filled, is made of impervious cardboard. Feeble bed-ridden patients should expectorate in moist rags or paper napkins, which should be burned before they have become dry. It need scarcely be said that the sputum should never be swallowed.

Consumptive patients should always sleep alone. Their rooms should be freely accessible to the sunlight, well ventilated, and kept scrupulously clean. Stuffed furniture, carpets, and woolen hangings are undesirable. All articles used by the patient and liable to be contaminated with sputum should be disinfected by means of scalding water.

Rooms which have been vacated by consumptives should not be occupied again until they have been thoroughly disinfected (see p. 387).

Phthisical patients should refrain from kissing and other modes of salutation necessitating very intimate association. Tuberculous mothers should not suckle their children. The marriage of consumptives should be discouraged.

Through the enactment and rigid enforcement of special laws much can be done by the State to limit the dissemination of tuberculosis. Laws should be enacted providing for the systematic inspection by skilled veterinarians of all dairies and slaughter-houses with the view of declaring unmarketable the milk and meat of tuberculous animals.

Compulsory registration of phthisical patients, although it entails great hardships on individuals and their families, is desirable. Flick is probably right in recommending that consumptives in the infectious stage of the disease should be retired from occupations in which they can infect others. Spitting upon sidewalks and the floors of public buildings and conveyances should be made a penal offence. Finally, the State should provide special hospitals for the indigent suffering from tuberculosis.

*The Individual.*—Persons with a marked predisposition to tuberculosis, whether hereditary or acquired, can do much to increase their power of resistance by strict attention to hygiene. Fresh air and sunlight, a healthy residence, an

outdoor occupation, the wearing of warm clothes, with flannel next to the skin, a diet of wholesome and nutritious food, temperate living, systematic exercise, and daily cold sponging, followed by friction of the skin, are the factors to be relied upon in attempting to overcome individual susceptibility.

Persons recovering from catarrhal pneumonia, pleurisy, measles, whooping-cough, influenza, and other diseases which predispose to tuberculosis should be treated with the utmost care. As enlarged tonsils, adenoid growths, and other obstructions in the upper air-passages, by interfering with free respiration, increase the risk of infection, they should be removed.

Finally, all local foci of tuberculosis, such as frequently appear in the cervical lymph-glands, joints, and bones, should receive immediate attention.

**Sanatorium Treatment.**—The value of pure air in the treatment of pulmonary tuberculosis is universally admitted. By adding to pure air an abundance of nourishment in a readily digestible form, rest alternated with graduated exercise, and constant medical supervision we supply our phthisical patient with the best means which medical science has at present to offer of securing restoration to health, or, if this be impossible, of obtaining alleviation of his symptoms. Indeed, if these measures are beyond the reach of the invalid all others are likely to prove unavailing. Nowhere are all the means just enumerated so available as in a well-managed modern sanatorium. Such an institution may be located in almost any climate, even within a few miles of a large city, the only requisites being moderate elevation, well-drained soil, abundant sunshine, and protection from cold winds.

*Open Air.*—In summer not less than nine or ten hours, and in winter not less than six or seven hours, are spent in the open air. In Falkenstein the patients remain out of doors in their chairs from seven to ten hours a day all the year round, in spite of fog, rain, wind, or snow, and even with the thermometer at 12° C. below zero, and often no sunshine (Knopf). Of course, they are sheltered from the wind and rain, and are well covered with blankets or fur robes. The bed-room windows are kept open both winter and summer. As a rule, patients soon accustom themselves to live in a low temperature without discomfort.

*Nourishment.*—When there is no gastric derangement the patient is given an ordinary diet of wholesome food, and encouraged to eat as heartily as his digestive capacity will permit. Milk, eggs, beef, mutton, lamb, fish, fowl, fresh vege-

tables, cereals, and fruits are considered suitable forms of nourishment. As a rule, the meals are given more frequently than in health. Thus, before rising the patient takes hot milk, cocoa, or gruel; at breakfast—beef-steak, chops, eggs, or fish, bread and butter, and coffee or milk; at the mid-day dinner—soups, fish, meat, vegetables, salad, fruit, and wine; at 4 o'clock—milk with bread and butter, milk with raw egg, or bouillon with toast; at supper—cold meat, bread and butter, cocoa, fresh or preserved fruit; at bed-time—a glass of hot milk or an egg-nog.

In some cases the anorexia is so pronounced that it becomes necessary to resort to forced feeding, but generally the patient can be persuaded to eat, especially if the food be presented to him in an appetizing form. Under the influence of fresh air the appetite often returns with remarkable rapidity.

*Rest and Exercise.*—When the disease is active the patient is kept at absolute rest. For most of the day he lies on a bamboo couch or a reclining chair in the open air, warmth being maintained by abundant covering and, if necessary, by a hot stone placed at the feet. In the incipient stage and in quiescent tuberculosis moderate exercise is generally recommended, every precaution being taken, however, to guard against fatigue.

*Medical Supervision.*—This is an important item of the sanatorium treatment. Everything that the patient does is reviewed by the attending physician, and the treatment is reduced to an organized system. "Success depends upon the ability of the doctor to discriminate and to shape his treatment according to the physical and mental wants of each individual case; the patient must not be made to feel that he is merely an inmate of an institution the régime and regulations of which he has rigidly to observe, but rather, that he is a well-liked guest, who, while conforming to certain rules of the house for the benefit of his health, is at liberty otherwise to enjoy life in his own fashion" (Muthu).

The results obtained under the sanatorium treatment fully justify its employment; it undoubtedly gives the patient in the early stage of the disease the best chance of complete recovery. The shortest period of treatment which will benefit a patient is rarely less than three months, and to secure a lasting improvement he should remain at least six months.

**Climatic Treatment.**—Since the open-air treatment has been shown to be about equally successful in nearly all countries, the selection of a special locality has become a matter of secondary importance. Still, there are some patients, with

ample means at their disposal, to whom a protracted stay in a sanatorium would become exceedingly irksome and distasteful. To such patients prolonged residence in a favorable climate offers the greatest hope of cure. The requisites of a suitable climate are purity of atmosphere, equability of temperature, and abundance of sunshine. The age of the patient, the extent and type of the disease, and the condition of the other organs must be carefully considered in deciding the question of altitude, of temperature, and of humidity. Other matters which should not be overlooked in choosing a locality are wholesome food in abundance and well-prepared, good accommodations, and available medical advice.

Young subjects with considerable constitutional vigor, who have but a small area of lung involved, generally do well in high altitudes, such as are found in Colorado, Wyoming, and Montana, and in Switzerland (Davos and St. Moritz). The presence of cardiac disease, albuminuria, or emphysema is to be regarded as a contraindication to high elevations.

The moderate elevation of the Adirondack Mountains and of the mountains of North Carolina is well adapted to many patients who have but a limited area of pneumonic consolidation, and who cannot afford to remain away from home longer than a few months.

Phthisical patients who have much tendency to bronchial catarrh, and who manifest great constitutional irritability, generally do better in warm climates with little elevation, such as Southern California, Southern Arizona, and Florida in this country, and the Riviera and Egypt abroad.

In some cases an extended sea-voyage is very useful. According to Douglas Powell, it is most suitable to patients in the early stages, who have been previously healthy, who have overworked nervous systems, and in whom the disease is more or less quiescent.

Patients in the advanced stages of the disease should not be sent far from home.

**Treatment at Home.**—The large majority of patients are unable to avail themselves of the advantages afforded by a stay in a sanatorium or by residence in a salubrious climate. These may be consoled by the fact that not a few cases of phthisis do well at home when the conditions are not too unfavorable. Treatment at home should be made to imitate as closely as circumstances will permit that which is followed in the sanatorium. An earnest attempt should be made to secure the freest possible supply of air and of sunlight. The airiest and sunniest room in the house should be selected for

the patient. *So long as he has fever absolute rest should be insisted upon.* During the day, if the weather be clement, he should rest in a reclining chair in the open air for from six to ten hours, according to the season, and at night sleep with the windows open. There is no danger, even in the presence of fever and sweating, in breathing cold air, providing the body itself is kept warm. As much nourishing food should be supplied as the digestive capacity of the patient will allow.

**Artificial Aerotherapeutics.**—Inhalations of *rarefied air* by means of the pneumatic cabinet have been found very beneficial by Platt, Quimby, Knopf, and others. A reduction of the atmospheric pressure about half a pound to the square inch is sufficient. According to Knopf, the séances should be given at first every day, and their duration should be gradually increased from two minutes to six or eight minutes.

C. Theodore Williams, who has had a large experience in the treatment of phthisis by means of *compressed air*, concludes that beyond lessening slightly the cough and expectoration, the baths are of no benefit. On the contrary, in several of the cases hemoptysis came on either in the bath or shortly after the treatment.

**Medicinal Treatment.**—The chief indications in the medicinal treatment of tuberculosis are to increase the resisting power of the tissue, to reduce the local irritation, and to relieve the distressing symptoms. It is the opinion of most clinicians of large experience that *tuberculin* (see p. 435) is of definite but limited value. Its administration, however, demands extreme care, as in unsuitable cases or in too large doses it is capable of doing irreparable harm. Patients who have little or no fever and whose general nutrition is fairly good are the ones most likely to be benefited by it. On the other hand, it should be avoided when there is rapid emaciation, high fever, a persistently frequent pulse, or active nephritis. Recent hemoptysis is also to be regarded as a contraindication. The dosage may be regulated either by following the opsonic-index curve or by closely observing the clinical manifestations. At no time should the quantity injected be enough to cause an immediate subjective or objective reaction.

In the last fifty years no remedy has been so universally esteemed in the treatment of phthisis as *cod-liver oil.* When well tolerated and digested it is undoubtedly of service in improving the general nutrition. It is to be regarded, however, as a food rather than as a medicine. If it occasion nausea, impair the appetite, or derange the digestion in any way, it should be withdrawn. The best methods of administering cod-liver oil have been considered on p. 304.

Olive oil, cream, and butter may be used as substitutes for cod-liver oil when the latter is not well borne.

*Arsenic* is another remedy which has many warm advocates. To be effective it must be given in small doses for several months. Jacobi speaks highly of arsenic in conjunction with digitalis in tuberculosis of childhood.

*Alcohol* is useful in some cases, but not in all. Each case must be carefully considered by itself. The danger of inducing the alcoholic habit must also be borne in mind. Malt liquors and wines are usually the best preparations when digestion is good, but when the digestive power is feeble whisky or brandy, well diluted, is preferable. Alcohol is best given with the food.

Various drugs which have tonic properties and tend to improve the general nutrition are of service in phthisis. Of these the most valuable are the *hypophosphites*, *strychnin*, and other *vegetable bitters*.

*Preparations of iodin* seem to be useful, especially in the early stages of the disease. A good method of administering iodin without deranging digestion is that of Flick, which is to rub into the chest twice daily an ointment (10 per cent.) of europhen, a compound containing a large percentage of loosely combined iodin.

*Creosote* (see p. 284).—While the view is no longer tenable that creosote exerts a specific influence on the tubercle bacilli, the testimony of numerous observers is convincing that the drug is of value in allaying cough and in lessening expectoration. It is especially useful when the sputum is very abundant and purulent. Creosote carbonate and guaiacol carbonate (see p. 286) do not have the disagreeable odor and taste of creosote itself, and appear to be equally efficacious.

*Counterirritation.*—This is a method of treatment less frequently employed than its merits justify. Counterirritation by iodin or, better, by small "flying" blisters, has seemed to the author to be of the greatest use, especially in chronic pulmonary tuberculosis.

**Treatment of Special Symptoms.**—*Digestive Disturbances.*—In a large number of phthisical cases the first indication is to correct disordered digestion. No medicines likely to irritate the stomach should be ordered. Only the most bland and readily digestible forms of nourishment should be allowed. The time of eating, as well as the character of the food, should be carefully revised. No special rules can be laid down for treatment. The various measures and drugs which are serviceable in the ordinary forms of indigestion

(see p. 555) are applicable here. The most potential measures are fresh air and rest. Acute indigestion brought on by overeating is often promptly relieved by a mercurial purge followed by a saline. When anorexia and slow digestion are the chief features, an alkali with a vegetable bitter before meals (see p. 175) may have a very happy effect.

Vomiting that is dependent upon extreme irritability of the stomach is often relieved by such sedatives as bismuth subnitrate and hydrocyanic acid (see p. 164), taken before meals. Emesis excited by cough sometimes subsides when the patient is kept in bed and put on a liquid diet. Chloroform-water taken a few minutes after the meals is useful. Counterirritation over the diseased area in the lung is very often successful. Vomiting occurring shortly after a meal and preceded with a sense of suffocation, with or without coughing, is best controlled by the administration of from 5–10 minims (0.3–0.6 c.c.) of liquor potassæ (Habershon). Vomiting caused by ulceration of the epiglottis or larynx will call for local anesthetics—cocain, iodoform, orthoform, and morphin.

*Cough.*—In many cases of phthisis cough is indispensable, and is best treated by promoting expectoration. For this purpose creasote, guaiacol carbonate, terebene, oil of eucalyptus, myrtol, and santal oil are reliable remedies. They may often be combined advantageously with strychnin. Expectorants in the form of syrups should be avoided. Morning paroxysms of cough are often made more easy by the administration of a glass of hot water before rising, to which aromatic spirits of ammonia has been added. Intratracheal injections (see p. 587) are also useful in modifying bronchial secretion and promoting expectoration.

Hard, dry cough calls for special treatment. When such cough results from habit, as is sometimes the case, it can be suppressed by discipline. Absolute rest is a valuable aid. Inhalations of creasote, chloroform, and volatile oils (see p. 587) are often very effective. Inhalations of formalin have been highly recommended by Murrell, Muthu, Huggard, and others. The strength of the solution should at first not exceed 2 or 3 per cent. of ordinary formalin in alcohol. From 5–10 minims (0.3–0.6 c.c.) of this solution should be used from time to time in an inhaler placed over the mouth only, the entire time of the inhalation being from three to six hours daily. The strength of the solution may be gradually increased to 6 per cent., or even to 10 per cent. When the cough is very irritable chloroform may be added to the inhalation.

In many cases of chronic phthisis no measure proves so

successful in relieving cough as blistering. Periodic fits of cough at night call for warm, demulcent, nourishing liquids, such as milk or beef-tea, with a little brandy, if there be much exhaustion (J. Mitchell Bruce).

When the cough is very violent and occasions exhaustion it may be necessary to resort to internal sedatives. Of these, those least objectionable are codein, heroin, and spirit of chloroform. The combination mentioned on p. 161 or one like the following will be found useful:

℞ Codeinæ sulphatis, gr. vi–viij (0.4–0.5 gm.);
Spiritus chloroformi, f℥j (4.0 c.c.);
Glycerini, f℥j (30.0 c.c.);
Succi limonis, f℥ss (15.0 c.c.);
Aquæ, q. s. ad f℥iij (90.0 c.c.).—M.
Sig.—A teaspoonful as occasion demands.

*Hemoptysis.*—Absolute rest is essential. An ice-bag may be placed over the suspected seat of the hemorrhage, but it should be removed at once if it aggravate the coughing. Bits of cracked ice may be given to the patient to suck. There is no more useful internal remedy than morphin, which serves to allay excitement and to check cough. It should be given hypodermically in full doses. The application of firm ligatures to the limbs, in order to lessen the volume of blood returning to the lungs, may prove efficacious.

When the hemorrhage is protracted a saline purge is sometimes useful. It probably acts by lowering the blood-pressure. The nitrites may prove beneficial in some cases. Among other remedies which seem to be of service may be mentioned oil of erigeron, fluidextract of hamamelis, and gelatin. Ergot cannot be recommended (see p. 378). Inhalations of vaporized solutions of astringent drugs, like alum and ferric sulphate are useless.

The assurance that pulmonary hemorrhage in phthisis is not necessarily a dangerous symptom or even a drawback to recovery has a most salutary effect on the patient. The prostration appearing after a first attack of hemoptysis is often, as Flint observed, a moral effect rather than the exhaustion caused by the loss of blood.

*Night-sweats.*—Sponging the body before bedtime with vinegar and water, alcohol and water, or formalin and alcohol often checks excessive sweating. Dusting the surface with a powder of tannoform (1 part) and zinc oxid (3 parts) is also effective. A glass of cold milk with brandy just before retiring sometimes affords relief. The most reliable internal remedies are atropin, picrotoxin, agaracin, sulphuric acid, and camphoric acid (see p. 263).

*Pyrexia.*—In many cases the pyrexia yields to absolute rest in bed or in a reclining chair, combined with life in the open air. Cold sponging is to be recommended when the temperature is high. In obstinate cases the administration of 2 or 3 grains (0.13–0.2 gm.) of phenacetin about two hours before the temperature is expected to rise may be tried. The high irregular fever resulting from secondary infection by pyogenic cocci is sometimes favorably influenced by creasote or one of its derivatives.

*Pleurisy.*—Mild attacks of pleuritic pain generally yield to sinapisms or the application of iodin. Strapping the affected side also affords relief. Severe pains should be treated by the application of a blister and the subcutaneous administration of morphin. The treatment of tuberculous pleurisy with effusion is much the same as that of primary pleurisy with effusion. Thoracentesis, however, is inadvisable when the effusion is only moderate and the patient is very feeble.

*Diarrhea.*—Diarrhea the result of indigestion usually yields promptly to restriction of the diet, rest, and the administration of a mild mercurial or saline aperient. When intestinal tuberculosis is present diarrhea becomes a most troublesome complication. Large doses of bismuth subnitrate, combined with opium in some form, may afford temporary relief. Combinations of tannigen or of tannalbin with intestinal antiseptics like betanaphtol-bismuth, salol, or thymol, sometimes prove useful. Pills of lead acetate and opium or of copper sulphate and opium occasionally succeed.

## PLEURISY.

The first indications in the treatment of acute pleurisy are to relieve the pain and to check the progress of the inflammation. For the first, the application of a blister or of wet or dry cups, together with the hypodermic injection of morphin, will be found effective. Strapping the affected side from mid-spine to mid-sternum with broad strips of adhesive plaster, as originally suggested by Frederick T. Roberts, is also very useful. Cold applications are not often tolerated.

Unfortunately, we have no very potent means of checking the inflammatory process in the pleura. The patient should be kept in bed and restricted to a liquid diet. A mercurial or saline aperient may be prescribed at the onset. Acute sthenic cases, accompanied by decided fever, are often favorably influenced by the administration of salicylates, a method of treatment which has been warmly advocated by Aufrecht, Fiedler, Dock, and others. From 1–1½ drams (4.0–6.0 gm.)

of sodium or ammonium salicylate should be given in the twenty-four hours, the dose being gradually reduced as the good effects become manifest. In asthenic, protracted cases of pleurisy the salicylates are of no avail.

After the acute symptoms have subsided the indications are to accomplish the removal of the fluid, to maintain nutrition, and to secure complete expansion of the lung.

*Removal of Serous Effusion.*—Counterirritation by means of iodin or flying blisters appears to be useful in promoting absorption. In vigorous subjects the administration of saline purgatives according to the method suggested by Matthew Hay is sometimes followed by improvement. The object of this treatment is to deplete the blood of its serum, and thereby favor the abstraction of fluid from the lymph-spaces. The quantity of fluid consumed by the patient is restricted to a minimum, and every morning or every other morning from ½–1 oz. (15.0–30.0 gm.) of magnesium sulphate is given in concentrated solution an hour before breakfast. This produces copious watery discharges.

Diuretics (digitalis, caffein, potassium acetate) are sometimes of service, but their action is much less certain than that of the purgatives. Potassium iodid has also been extensively employed as an absorbent, but is of doubtful efficacy. Diaphoretics (hot-air baths, pilocarpin) cannot be recommended.

While the effusion eventually disappears in a large proportion of cases under medicinal treatment alone, much saving of time is often effected by an early resort to paracentesis. In the author's opinion this operation should not be delayed ordinarily longer than ten days or two weeks when the effusion is considerable and shows no signs of receding. The presence of fever is not a contraindication; indeed, the temperature often falls upon the removal of the fluid.

Irrespective of the period of the disease paracentesis is demanded: (1) When there is sufficient fluid to excite severe dyspnea, cyanosis, persistent cough, or failing pulse; (2) When the fluid reaches the level of the second rib, and there is marked dislocation of the neighboring organs. The suspected presence of pus is always to be regarded as sufficient ground for operative interference.

*Paracentesis.*—The patient should be brought to the edge of the bed, placed in a semirecumbent position with the thorax inclined slightly toward the healthy side, and supported by an assistant. The most favorable site of the puncture is usually the sixth or seventh intercostal space between the mid-axillary line and the angle of the scapula. The operation should

be done under strict antiseptic precautions. The needle should be inserted with a quick thrust along the upper margin of the rib, the depth of the puncture being gauged by the forefinger. Local anesthesia is not necessary, but if desired it may be secured by means of a spray of ethyl chlorid or the application of a block of ice which has been dipped in salt. Having introduced the canula, the operator should satisfy himself that it is freely movable, should hold it in position throughout the operation, and as the evacuation proceeds should slowly raise the exposed end so as to keep the inner opening below the level of the fluid in the pleural sac. The aspiration should be effected slowly, and at intervals it should be stopped by compressing the conducting tube. Too rapid evacuation may excite engorgement of the lung and edema.

The amount of fluid which should be removed depends somewhat upon the size of the effusion and the ease with which it can be evacuated. Even with large effusions it is rarely necessary to withdraw more than a quart (1.0 L.). The removal of small quantities is in many cases followed by the rapid absorption of the remainder. Under no circumstances should extreme efforts be made to obtain the largest possible amount of fluid. The operation should be terminated at once if incessant cough, severe pain, dyspnea, palpitation, tendency to syncope, or other untoward symptoms appear.

When the requisite amount of fluid has been evacuated, the needle should be withdrawn quickly from the chest, and the puncture closed with adhesive plaster.

If the exudate reaccumulate, aspiration may be repeated after the lapse of a week or ten days. Free incision of the thoracic wall with thorough drainage has given excellent results in cases in which the fluid has reaccumulated after repeated tappings.

Occasionally attempts at aspiration are unsuccessful. The cause of failure may be plugging of the canula, great thickening of the pleura, or encapsulation of the effusion. Under these circumstances it may be necessary to make repeated trials before a flow can be established. The aspiration of pleural exudates is rarely attended by accidents of any kind. Sudden death, the result of cerebral anemia, has been reported. Such an accident is not likely to occur if the evacuation be effected slowly and arrested immediately on the first appearance of any untoward symptom. Another grave and even fatal complication of thoracocentesis, but also extremely rare, is a peculiar form of pulmonary edema, which is manifested by cough, in-

tense dyspnea, and profuse albuminous expectoration. According to Riesman, who has collected 32 cases from the literature, the principal cause of this condition seems to be either too rapid or too great a withdrawal of fluid.

*To Maintain Nutrition and Secure Complete Expansion of the Lung.*—Apart from the restriction of liquids the diet during the stage of resorption should be abundant and nutritious. Tonics like iron, cod-liver oil, and arsenic are very useful. After the exudate has entirely disappeared the patient should be urged to take such exercises as will bring into play the muscles of respiration. Open-air living and change of climate are also to be recommended, especially when there is a decided phthisical tendency.

**Empyema.**—The treatment of empyema is surgical. The indications are to evacuate the pus and to secure thorough drainage. Simple puncture cannot be recommended, although in children repeated tappings sometimes result in cure. In the large majority of cases treatment by free incision and the introduction of a large-sized drainage-tube proves successful. Irrigation of the pleural sac should not be practised unless the exudate is putrid.

Excision of one or more ribs (Estlander's operation) or excision of the ribs and intercostal tissues (Schede's operation) may be necessary when the empyema is of long standing or occurs in elderly persons with rigid thoracic walls. Fowler recommends, in chronic empyema, decortication of the lung in preference to either Estlander's or Schede's operation, claiming that it combines the advantages of restoration of the function of the lung, so far as this is possible, with closure of the empyemic cavity.

## DISEASES OF THE CIRCULATORY SYSTEM.

### PERICARDITIS.

One of the chief indications in the treatment of acute pericarditis is to allay the excited action of the heart. Absolute rest of body and mind is imperative. During the first week, at least, milk is the most suitable diet. Among local applications none is so generally useful in subduing palpitation as the ice-bag. Local blood-letting is of great service when the disease occurs in a fairly robust subject and is attended with much pain. Blistering also serves to allay pain, but it does not seem to exert any influence on the progress of the disease. Internally, morphin is often required to control restlessness and to relieve pain

Drugs which stimulate the cardiac inhibitory mechanism are of doubtful utility, although digitalis may be given when acceleration of the pulse is accompanied by decided lowering of the arterial tension. If heart failure occur such stimulants as alcohol, strychnin, caffein, and camphor must be employed.

**Pericardial Effusion.**—When the exudate is serofibrinous, is moderate in amount, and causes no marked subjective symptoms, an expectant plan of treatment may be pursued with the assurance that resolution will follow in due time. When, however, the effusion is extensive and causes some embarrassment of the heart's action, efforts should be made which will tend to hasten absorption. Of the value of vesicants in this stage there can be no reasonable doubt. If the patient's strength will permit, saline purges may be administered in the manner suggested by Matthew Hay (see p. 602). Diuretics, such as digitalis and caffein, may be tried. Potassium iodid is recommended, but it is of doubtful efficacy. Diaphoretics, particularly pilocarpin, should not be used.

In cases in which the symptoms become urgent, or in which absorption does not occur after a thorough trial of the remedies just mentioned, operative interference becomes necessary. In the case of serofibrinous effusions, aspiration is the operation of choice, although it yields far less favorable results than it does in pleurisy. The most suitable site for paracentesis is ordinarily in the left fifth intercostal space, about an inch or an inch and a half from the edge of the sternum. According to Osler, in large effusions the pericardium can also be readily reached without danger by thrusting the needle upward and backward close to the costal margin in the left costoxiphoid angle. In a number of instances, owing to an error in diagnosis, the needle has pierced the right ventricle. Fortunately, this accident has rarely produced serious consequences, although Broadbent recalls two cases in which it resulted fatally through hemorrhage.

In pericarditis with purulent effusion the indications are to incise the sac and to afford the freest possible outlet for the pus. Three methods of approaching the pericardium have been practised: By incision through an intercostal space, by trephining the sternum, and by epigastric incision. C. B. Porter excises the cartilage of the fifth rib, ligates the internal mammary vessels, and, after introducing a needle to corroborate the diagnosis, opens the pericardium obliquely downward and outward close to the border of the sternum. He then stitches the edges of the pericardium to the skin, irrigates, and introduces two rubber drainage-tubes. The advantages claimed for

this operation are that it avoids opening the pleura and secures permanent free drainage.

The mortality of incision for pyopericardium in 47 cases was about 60 per cent.

## ACUTE ENDOCARDITIS.

The treatment of acute endocarditis is mainly that of the causal condition. Too much emphasis cannot be given to the need of frequent examination of the patient's heart during the course of all acute infections, in particular of acute articular rheumatism, even of the mildest type (see page 536). The special indication is to secure complete resolution of the inflammatory process or, if this be impossible, to favor the establishment of the highest attainable degree of compensation. *Prolonged and complete rest* is the most important factor of the treatment. The patient should be confined to bed not only during the attack, but for several weeks after it has subsided, in order to allow sufficient time for the damage to be repaired or for compensatory hypertrophy to be thoroughly established. In the period of convalescence extraordinary efforts are often required to prevent those indiscretions which are so liable to cause a fresh invasion of the valves or to strain the already overburdened heart. Mental and emotional excitement must also be avoided as much as possible, since they both tend to increase the force and frequency of the pulse. The diet should be liquid and unstimulating. For a week or two milk is the most appropriate food; later milk-toast, eggs, thin gruels, light broths, and steamed rice are admissible.

Externally, an ice-bag is often useful in allaying excitement of the heart. Internally, at the outset and from time to time throughout the illness, mild mercurial or saline aperients may be used for their depurative effect. Digitalis may be of service when the pulse is weak and irregular, but in the large majority of cases this remedy is not indicated. Heart-failure is to be combated by such stimulants as alcohol, ammonia, strychnin, and caffein. Morphin is sometimes required to relieve severe pain, allay nervous perturbation, and to promote sleep. To these measures is to be added, of course, the treatment appropriate to the disease upon which the endocarditis has supervened.

Treatment by continuous vesication and the prolonged administration of potassium iodid has seemed to most practitioners of large experience to be of doubtful utility, although it has been ardently advocated by Pepper in this country, André

Petit in France, Rosenstein in Germany, and Walsh and Caton in England.

Caton,[1] especially, has presented some very strong evidence in favor of these measures as auxiliaries to prolonged rest in bed. He reports that of 39 cases of acute endocarditis treated by this method, 29 left the hospital with normal heart-sounds and 10 with a bruit, and that of 13 treated expectantly 12 left the hospital with a bruit. Many of the cases were kept under observation subsequently for a long period, and every care was taken to make the observations accurate.

## CHRONIC ENDOCARDITIS.

**Period of Compensation.**—Treatment during this stage must be chiefly hygienic. No specific medication should be advised unless there be a definite indication for its employment. Our aim should be to maintain the heart-muscle in the highest possible state of efficiency by carefully regulating the habits of life, preventing excessive cardiac strains, and protecting the patient against intercurrent diseases likely to induce a fresh attack of endocarditis or to weaken the myocardium. In many cases it is well to inform the patient of his valvular defect, without unnecessarily alarming him, in order to secure his thorough coöperation.

Violent exertion, mental fatigue, intense emotional excitement, intemperance in eating and drinking, and venereal excesses are to be rigidly avoided. As a protection against rheumatism and bronchitis the patient should habitually wear flannel next to the skin, and should avoid unnecessary exposure to cold and wet. In the absence of any digestive disturbances, a varied diet of plain wholesome food is suitable. The meals should be taken at regular intervals, and followed by a rest of from twenty to thirty minutes. In elderly persons and those inclined to obesity a spare diet is generally advisable. Tea, coffee, alcohol, and tobacco should be used very moderately, if at all. The bowels should be made to move daily, a mild aperient being given if necessary, and the skin should be kept active by frequent tepid baths.

Exercise judiciously employed is often of the greatest benefit in prolonging the period of compensation. It is very important, however, that the muscular efforts should be carefully graduated and adapted to the working capacity of the heart. The character and duration of the exercises must be determined experimentally in each individual case, the subjective

[1] *Liverpool Med.-Chirurg. Jour.*, July, 1895.

symptoms of the patient being taken as a guide. All physical effort should stop short of producing palpitation, pronounced dyspnea, or fatigue. In persons who have just recovered from acute endocarditis the exercise should be confined to massage and passive movements, as originally practised in Sweden by Ling. In cases in which compensation has been completely established, but is maintained with some difficulty, exercises consisting of movements made against slight resistance, as carried out by Schott, of Nauheim, may be recommended (see p. 488). Vigorous patients may derive some benefit from the method of treatment urged by Oertel, which consists in graduated climbing exercises taken in the open air at a moderate elevation.

It is not often necessary to recommend a change of occupation unless the patient be engaged in a pursuit requiring a great expenditure of energy. Children with chronic valvular disease in whom compensation has been perfectly established need not be debarred from outdoor games which involve only moderate exertion. Thus, baseball, cricket, golf, and lawn tennis are usually permissible. On the other hand, amusements which require sudden or prolonged effort, such as racing, swimming, football, and wrestling, had better be avoided.

General tonics, like iron, arsenic, and cod-liver oil, may be used with advantage when there is distinct anemia or impaired nutrition.

**Period of Broken Compensation.**—The most important element in the treatment of this stage of chronic valvular disease is *absolute rest*. Under the influence of this alone it frequently happens that the urinary secretion increases, the venous engorgement and edema subside, and compensation is gradually restored. While the recumbent posture is generally preferable, it is sometimes advisable to consult the inclination of the patient and to allow him to sit up in an arm-chair, propped up by pillows and carefully protected from the cold.

When the digestive functions are well maintained a carefully selected mixed diet may be allowed. Eggs, oysters, sweetbread, scraped beef, lean lamb or mutton chops, white meat of chicken, boiled fish, baked potato, steamed rice, well-made gruels, toast, junket, wine jelly, and plain custard are suitable forms of nourishment. Coffee and tea should be used very sparingly, if at all. Alcohol in the form of brandy or whisky is often of great value. Full evening meals should be avoided, the chief meal being taken in the middle of the day. When there is much flatulence benefit will be derived from a considerable limitation of the carbohydrates. When the cavities of

the heart are overfilled and there is decided edema, it is often very advantageous to reduce the ingestion of liquids to a minimum, although in this as in other matters pertaining to the diet we should be guided largely by observation. In severe cases it is often a good plan to restrict the diet, at least for a time, to milk, giving from 3–4 ounces (90.0–120.0 c.c.) every two hours.

Should these measures prove inadequate to restore the equilibrium of the circulation, recourse must be had to special cardiac stimulants. The best and most reliable of these is *digitalis*. The chief indications for using this drug are frequency, weakness, and irregularity of the pulse, edema of the limbs, and deficient urination. When these symptoms are present digitalis may be employed whatever the nature or seat of the lesion. From 10–20 minims (0.6–1.2 c.c.) of a good tincture may be given two or three times a day (see p. 50). The first evidences of its beneficial effects are an increase in the secretion of urine and an improvement in the rhythm and tone of the pulse. Failure to secure immediate results should not cause disappointment, as decided benefit may not be observed until thirty-six or forty-eight hours after the institution of treatment. Digitalis is of most service in mitral regurgitation. In mitral stenosis its action is less certain, but nevertheless it may be prescribed with considerable confidence when there is failure of the right ventricle with dropsy and ischuria. In disease of the aortic area it must be used with some circumspection. When the chief symptoms are slight dyspnea, precordial distress, vertigo, and tendency to syncope, it generally fails or acts unfavorably, but when venous congestion, cyanosis, and edema appear as the result of back pressure in the heart and lungs, it frequently does good. In many cases certain adjuvants must be employed before digitalis can be made effective. When the right side of the heart is embarrassed and the tissues are engorged, purgatives are essential. Without their aid digitalis may afford little or no relief. Mercurial aperients are specially serviceable in lowering the venous tension. An appropriate dose of calomel or blue mass may be given in the evening, and followed in the morning by a saline. Subsequently, in some cases it is advantageous to combine the mercury with the digitalis, as in the well-known Niemeyer's pill (see p. 52). When the right ventricle is greatly overdistended and cyanosis is marked, venesection to the extent of a pint (0.5 L.) or more often affords prompt relief. Indeed, in this condition digitalis usually proves wholly unavailing when used before the veins have been thus depleted.

*Strychnin* is one of the most valuable accessories to digitalis we possess. It is particularly useful in temporary breakdowns of compensation in which there are pulmonary complications. When the myocardium is much involved it may often be given for many months or even years with benefit. *Caffein* is another remedy that may in many cases be combined advantageously with digitalis. It is especially serviceable when dropsy is a prominent symptom. Its chief drawback is its tendency to induce restlessness and insomnia. Excellent results are frequently obtained by giving *nitroglycerin* or one of the other nitrites in conjunction with digitalis when there is high arterial tension or considerable precordial pain. In myocardial degeneration it serves a useful purpose as corrigent of digitalis in counteracting the constricting effect of the latter on the blood-vessels. In cardiorenal disease with persistent or paroxysmal dyspnea it is also useful. *Iron* and *arsenic* are valuable adjuncts to digitalis when there is anemia. The latter especially has been highly extolled by Balfour, Bramwell, and others in cases of aortic regurgitation and of fatty or fibroid heart with anginoid symptoms.

As a circulatory stimulant *strophanthus* is distinctly less reliable than digitalis, although it is somewhat more prompt in its action than the latter. It may be used in the cases in which digitalis is not well borne by the stomach or fails to give the desired result. It is also very valuable as an alternate when the administration of digitalis must be interrupted. *Convallaria* and *adonidin* may be mentioned as drugs which occasionally succeed after digitalis and strophanthus have failed.

**Treatment of Special Symptoms.**—*Dropsy.*—In many cases absolute rest in bed, restriction of liquid ingesta, and the administration of digitalis suffice to restore compensation and, consequently, to remove the dropsy. Gentle massage of the affected parts by promoting the lymphatic and venous return is often beneficial. The application of smooth firm bandages to the swollen limbs sometimes affords much relief. Purgatives are very valuable, although some caution must be exercised in their employment lest they prove exhausting to the patient. Salines in concentrated solution, compound jalap powder (30–40 gr.—2.0–2.6 gm.), and elaterin ($\frac{1}{20}$ gr.—0.003 gm.) should be tried in the order named. Diuretics are also useful. Digitalis, on account of its favorable influence on the circulation, is generally the most suitable. The best adjuvants are caffein, the vegetable salts of potassium, theobromin, theocin, and squill. The following mixture of potassium acetate and the infusion of digitalis often acts happily:

℞ Potassii acetatis, ℥ij (8.0 gm.);
Infusi digitalis, f℥iij (90.0 c.c.).—M.
Sig.—A tablespoonful three or four times a day.

Another time-honored remedy is the pill containing 1 gr. (0.065 gm.) each of blue mass, digitalis, and squill, which may be given every three or four hours until diuresis, free purgation, or both, are obtained. It is generally inadvisable to employ diaphoretics like hot-air or vapor baths and pilocarpin, since they may induce profound exhaustion.

When all other measures have failed recourse may be had to paracentesis of the internal cavities and to scarification of the most swollen and most dependent parts. The insertion of fine silver canulæ with thin rubber tubes attached (Southey's tubes) often serves to drain off large amounts of fluid. Not infrequently curved incisions behind the ankles prove less annoying to the patient than either scarification or the insertion of tubes. Strict antiseptic precautions must always be taken in carrying out any of these operative measures, otherwise septic inflammation is very liable to ensue.

*Dyspnea.*—Chief reliance must be placed upon those measures which have already been recommended as useful in restoring the balance of the circulation. Free wet cupping or venesection is of the greatest service in relieving dyspnea the result of pulmonary engorgement. Counterirritation by means of sinapisms is much less efficacious. Oxygen inhalations are sometimes useful. Aspiration will be required in cases of hydrothorax. The nitrites are very valuable in paroxysmal dyspnea or cardiac asthma, especially when high arterial tension coexists. Dyspnea excited by flatulent distention of the stomach is usually promptly relieved by carminatives—spirit of chloroform, Hoffmann's anodyne, or spirit of mint. In many cases no remedy is so reliable as morphin. In the later stages of heart-disease it is indispensable. It should be given hypodermically in doses of from $\frac{1}{8}$–$\frac{1}{6}$ gr. (0.008 gm.–0.01 gm.) combined with atropin ($\frac{1}{200}$ gr.—0.0003 gm.). Morphin should not be used, however, when there is edema of the lungs.

*Palpitation.*—Cold to the precordia is a valuable sedative. When there is marked hypertrophy of the heart with a bounding pulse aconite (1–3 min.—0.06–0.25 c.c., every three hours) will be found of service. Palpitation of purely nervous origin is often benefited by the administration of bromids. When flatulence is an exciting factor carminatives usually afford relief. When the attacks are obstinate and interfere with sleep morphin is to be recommended.

*Pain.*—Temporary precordial oppression is often relieved by warm or cold applications and the administration of Hoffmann's anodyne or brandy with aromatic spirits of ammonia. Severe continuous pain may yield to leeching or blistering. In paroxysmal pain of an anginoid character, nitroglycerin will generally be found a speedy remedy. In the anginoid pains, which frequently occur in aortic disease, potassium iodid, 10 gr. (0.65 gm.), thrice daily, is also of service. In some cases morphin is the only remedy that will afford complete relief.

*Cough and Hemoptysis.*—These symptoms rarely call for special treatment. Cough occurring after failure of compensation is referable to pulmonary congestion and bronchial catarrh, and can be controlled successfully only by remedies employed directly against the cardiac failure. Hemoptysis is not often excessive and is generally salutary. When it is attended with dyspnea and precordial distress it calls for venesection or leeching and aperients.

*Vomiting.*—Vomiting may be due to faulty diet or to digitalis or other medicines. In many cases, however, it is of serious import, being the result of stasis in the vessels of the stomach. In severe cases it is advisable to rest the stomach. No food should be given by the mouth except a little iced champagne with Apollinaris, brandy with soda-water, or milk with lime-water, whey, or liquid peptonoids. Calomel in fractional doses is useful in depleting the engorged portal system. Anti-emetics (see p. 168) are seldom efficacious. Sinapisms over the epigastric region sometimes afford relief. Cardiac stimulation is best maintained by administering digitalin and strychnin hypodermically.

*Insomnia.*—In mild cases Hoffmann's anodyne (f3ss–f3j—2.0–4.0 c.c.) or a mixture of aromatic spirits of ammonia with whisky may suffice. Bromids are sometimes serviceable. Of the more active soporifics, veronal, chloralamid, and trional are worthy of confidence. Bramwell has found paraldehyd very useful in cases in which there is associated bronchitis. Chloral should usually be avoided on account of the depression it causes. On the whole, no somnifacient is so generally efficacious as morphin, especially when sleeplessness is attended with pain, precordial anxiety, and restlessness. One-sixth of a grain (0.01 gm.) with $\frac{1}{150}$ gr. (0.0004 gm.) of atropin, hypodermically, is often sufficient.

*Sudden heart-failure* must be met by the administration of diffusible stimulants, such as ammonia, alcohol, and ether. The application of heat to the precordia is also useful.

## CHRONIC MYOCARDIAL DISEASE.

Attention to the minutiæ of life is of the utmost importance. No one "rule of thumb" can be laid down for every patient. Each individual must be carefully studied as regards the state of the arteries, the character of the pulse, the digestive powers, the existence or absence of any constitutional vice, and the actual condition of the heart, so far as this can be ascertained. Exercise and diet are the points to which attention should first be directed. It is not always necessary that the patient should give up his occupation, but it is imperative that the sum of his exertions should be carefully adapted to the strength of his heart. It must be borne in mind that the fret and worry incident to many pursuits may exert as baneful an effect upon the circulation as undue physical effort. In some cases when the pathologic changes are not far advanced, and particularly if they consist in fatty overgrowth rather than degeneration of the muscular fiber, graduated exercises coupled with warm saline baths, as in the well-known Nauheim treatment (see p. 488), have a very salutary influence. When, however, palpitation, irregularity, pain, or pronounced dyspnea follow exertion, absolute rest is essential. In such cases massage is very useful, since it gives the patient the advantages of exercise without throwing any strain upon his heart.

As with exercise so with diet, no hard and fast rules can be laid down. The diet must be carefully adapted to the digestive powers and to the needs of the system. Rich foods, bulky foods, and foods which induce flatulence should be withheld. Eating between meals should be prohibited. The question of the quantity of food is also a matter of great importance. Degenerative changes in the heart usually occur at a period of life when the amount of food can often be considerably restricted without impairing the general nutrition. Chambers, Balfour, and others have dwelt upon the advisability of restricting the amount of liquids taken with meals in the case of failure of the myocardium. By this means the tension in the venous system may be lowered and the arterial resistance reduced. If thirst be complained of it is better for the patient to sip a moderate amount of hot water between meals than drink copiously during meals. Some judgment, however, must be exercised in the matter of drink, as the amount of liquid required to secure a free evacuation of waste products from the system must vary in different cases.

Tea and coffee should be used very sparingly, if at all. Alcohol also is better dispensed with. Smoking should be

forbidden. Excesses of all kinds must be rigidly avoided. Constipation must be relieved. When it does not yield to judicious exercise and the regulation of diet, an aloetic aperient (see p. 565) should be given at night or a mild saline in the morning. This may be supplemented from time to time by a pill of blue mass. In many cases no single remedy affords such prompt relief from the general distress as a mercurial laxative.

If there be a gouty diathesis it should be met by appropriate treatment, and if syphilis be a factor antiluetic remedies should be employed.

As to special treatment, strychnin appears to be the most generally useful drug. In doses of from $\frac{1}{60}$ to $\frac{1}{30}$ gr. (0.001–0.002 gm.), two or three times a day, it rarely fails to be of some benefit. When there is anemia iron is a useful adjuvant. Arsenic in small doses, over long periods, is often of the greatest service. Balfour considers that "arsenic is indispensable in all forms of weak heart accompanied by pain." He recommends it in combination with iron and strychnin, twice a day, after food. Nitrites usually prove very beneficial in cases in which high arterial tension, anginoid pains, or cardiac asthma are prominent symptoms. Huchard and others have spoken in the highest terms of the prolonged use of the iodids, especially when angina pectoris is a feature of the cardiac failure. They are most effective, as Osler has stated, in robust middle-aged men in whom the angina is the sole symptom. They are contraindicated when the myocardial disease is associated with advanced arterial degeneration and chronic nephritis.

Digitalis is of service in some cases. The less advanced the degeneration the more likely is it to be useful. Large doses are generally badly borne, but persistently employed in doses of 2 or 3 minims (0.1–0.2 c.c.) of the tincture, twice a day it often exerts a most favorable tonic effect. Even with these small doses of digitalis it may be necessary to guard against the constricting influence of the drug on the arterioles by combining with it a vasodilator, such as nitroglycerin, erythrol tetranitrate, or sodium nitrite. Not infrequently tincture of strophanthus, in doses of 3 or 4 minims (0.2–0.25 c.c.), twice daily, proves more efficacious than digitalis. When neither digitalis nor strophanthus is well received, caffein, convallaria or adonidin may be tried.

For the treatment of the more serious symptoms of cardiac failure the reader is referred to the article on Chronic Endocarditis (see p. 607).

## ANGINA PECTORIS.

The general treatment of true angina pectoris is for the most part that of myocardial degeneration. The patient should lead a quiet, easy life, should avoid, as far as possible, all mental and physical excitement, and should abstain, as a rule, from tobacco and alcohol. Small meals of readily digested food are to be recommended. The evening meal especially should be light. Muscular exertion or mental excitement after meals is particularly injurious. The bowels should be kept regularly open, mild aperients being used for the purpose if necessary. Unless the heart is very weak and sensitive gentle exercise in the fresh air is to be recommended. Cold, however, is to be avoided. After a very severe attack it is generally necessary to enjoin absolute rest in bed for several days. Any constitutional disease that may be present, such as gout or syphilis, must receive appropriate treatment. In the anemic and debilitated, tonics, especially iron and strychnin, are very useful. The most valuable special remedies in the order of their efficacy are the nitrites, the iodids (see p. 614), and arsenic.

**The Attack.**—When the attacks are brought on by indigestion they can frequently be staved off by the timely use of a brisk mercurial or saline purge. Marked flatulency should be met by the prompt administration of a stimulant carminative like spirit of mint, Hoffmann's anodyne, or spirit of camphor. For the instant relief of the pain no drug is so useful as amyl nitrite. In the majority of cases a mere whiff of this speedily arrests the paroxysm. The patient should carry the remedy on his person in a small vial or, better, in the form of glass pearls containing from 3–5 min. (0.2–0.3 c.c.), which can be broken in a handkerchief and inhaled as soon as he perceives the pain. When the attacks are severe and prolonged, morphin ($\frac{1}{4}$–$\frac{1}{2}$ gr.—0.016–0.032 gm.) should be given hypodermically. In some cases, as Yeo has pointed out, there is a remarkable tolerance of this drug. Atropin is a valuable adjunct to morphin. When amyl nitrite and morphin fail, recourse should be had to chloroform inhalations (see p. 127). The application of a mustard plaster to the precordial region is often useful. In those cases in which the attacks occur in very rapid succession flying blisters or light touches of the actual cautery sometimes bring relief. The cardiac depression following grave seizures should be combated by such drugs as strychnin, ammonia, ether, and camphor.

# DISEASES OF THE KIDNEYS.

## ACUTE NEPHRITIS.

Absolute rest in bed for a period varying from four to six weeks is imperative. Even after the patient feels perfectly well he should not be permitted to leave his bed until the urine has been absolutely free from albumin for at least a week.

The patient should be well covered, woolen being worn next to the skin, and great care should be taken to guard against draughts.

The best diet for acute Bright's disease is *milk*. While it is desirable to add to the milk one-fourth or one-third part of lime-water, barley-water, carbonated water or Vichy, it is not advisable for the patient to drink excessive quantities of water. Beef-tea and broths should be interdicted. When the kidneys begin to secrete more actively, thin gruels, rice, and milk-toast may be given. During convalescence, bread and butter, baked potatoes, green vegetables, and fruits are permissible. The return to nitrogenous food should be most gradual, the effect on the urine of each addition to the diet being carefully watched.

In the absence of any direct remedies the indications are to divert the blood from the inflamed kidneys, to lessen their work as much as possible by increasing the action of the bowels and skin, and to meet the symptoms as they arise.

At the onset, if there be pain or suppression of urine, dry cupping, or, in severe cases, wet cupping, over the region of the kidneys is of value. Following the cupping warm poultices may be applied to the loins with advantage. Cantharides, turpentine, or similar drugs are not to be used.

The bowels should be kept freely opened by means of daily purges, the best in this condition being salines in concentrated solution and compound jalap powder. For children magnesia will be found sufficient. Very vigorous purgation is not called for unless there be dropsy or uremia.

Free sweating is very useful in promoting elimination by the skin. It may be effected by means of hot-water baths, hot packs, vapor baths, or hot-air baths (see p. 494). In children hot baths and hot packs are eminently satisfactory, especially if spirit of nitrous ether or solution of ammonium acetate be administered at the same time. If the baths afford but little relief their action may be supplemented by the hypodermic administration of pilocarpin in doses of from $\frac{1}{15}$–$\frac{1}{10}$ gr. (0.004–0.0065 gm.).

There is much difference of opinion as to the use of diuretics. Some observers believe that all diuretics are irritating to the kidneys and therefore should be withheld at least during the stage of engorgement. Most authorities admit, however, that mild alkaline diuretics, like the vegetable salts of potassium, often serve a useful purpose in removing from the uriniferous tubules proliferated epithelium, albuminous plugs, and effete matter. From 20–30 gr. (1.3–2.0 gm.) of the citrate or acetate of potassium may be given three or four times a day, well diluted. Later in the disease, when the pulse tension falls, experience has proved that digitalis is often of great value. From 2–4 fl. dr. (8.0–15.0 c.c.) of the infusion should be given every three or four hours. It may be combined advantageously with an alkaline diuretic as in the following formula:

℞ Potassii acetatis, ℥ij (8.0 gm.);
Infusi digitalis, f℥iij (90.0 c.c.). M.
Sig.—A tablespoonful, well diluted, every four hours.

**Symptomatic Treatment.**—The symptoms of acute nephritis which may demand special attention are excessive dropsy, uremia, nausea and vomiting, and anemia.

*Excessive Dropsy.*—When the dropsy is extreme and does not yield to the purgative, diaphoretic, and diuretic remedies which have already been indicated, recourse must be had to puncture of the swollen parts, to free incision on the inner or outer side of each ankle, or to the insertion beneath the skin of Southey's tubes (see p. 611).

Large accumulations in the serous sacs should be removed by paracentesis.

*Uremia.*—This complication calls for very prompt and energetic treatment. The chief indication is to favor the elimination of effete matter through the only available emunctories—the bowels and the skin. Two drops (0.065 c.c.) of croton oil, diluted with olive oil or glycerin, or $\frac{1}{6}$ gr. (0.01 gm.) of elaterium should be given at once. Sweating should be promoted by hot-air or vapor baths and the hypodermic administration of pilocarpin ($\frac{1}{4}$–$\frac{1}{3}$ gr.—0.015–0.02 gm.). If coma or convulsions appear, and the patient is not too feeble, venesection may be practised, the removal of from 15 to 20 ounces (450.0–600.0 c.c.) of blood sometimes exerting a very happy effect. In children a few ounces of blood may be abstracted from the loins by means of wet cups. Hypodermoclysis is another potent remedy (see p. 496). It may be resorted to whether blood-letting is deemed necessary or not, although it is more

efficacious when practised after blood has been withdrawn. Enteroclysis (see p. 498) is also useful, though less effective than the subcutaneous injection of salt solution.

Convulsions may be controlled by chloroform inhalation or the administration of chloral. If the patient be unable to swallow, from 20–30 gr. (1.3–2.0 gm.) of chloral may be injected into the rectum. If these measures fail, morphin may be used cautiously (see p. 97).

*Nausea and Vomiting.*—When these symptoms persist food should be withheld. Pieces of ice may be given to suck. A mixture containing bismuth subnitrate and diluted hydrocyanic acid (see p. 161) often affords relief. Carbolic acid, wine of ipecac, or tincture of nux vomica, in one-drop doses, may be tried.

*Anemia.*—After the acute symptoms have subsided iron may be employed to combat the anemia. For adults Basham's mixture is a suitable preparation. Of this from 2–4 fl. dr. (8.0–15.0 c.c.) may be given thrice daily. For children the following mixture will be found more agreeable:

℞ Tincturæ ferri chloridi;
Acidi phosphorici diluti, *āā* ʒiss (6.0 c.c.);
Glycerini, ʒvj (22.5 c.c.);
Syrupi acidi citrici, q. s. ad ʒiij (90.0 c.c.). M.
Sig.—Teaspoonful in water three times a day.

**Convalescence.**—It is advisable to keep the patient under observation for many weeks after all symptoms of the disease have disappeared. He should be warmly clad and carefully guarded from exposure to wet and cold. While the diet should be liberal it should be such as will not overtax the kidneys. Overexertion must be rigidly avoided. The skin and bowels should be kept active, the former by frequent tepid baths and the latter by saline aperients if necessary. A change of air to a warm, equable climate will be found to be very beneficial.

## CHRONIC NEPHRITIS.

The indications for treatment in chronic nephritis are to lessen the work of the kidneys by reducing the production of nitrogenous waste and increasing the activity of the other excretory organs, to maintain the general nutrition, and to meet the symptoms as they arise. The patient must be guarded against vicissitudes of weather by wearing flannel next to the skin in all seasons, both night and day. If he can afford it he should be urged to spend the winter months in a warm, equable climate.

In the absence of any obtrusive symptoms, moderate exercise short of fatigue should be encouraged, but all violent exertion should be prohibited. Mental strain and worry are also injurious, and should be avoided as far as possible. When the symptoms are well developed rest becomes an important factor in the treatment, and much time should be passed in bed. The use of tobacco and alcohol should be discontinued. Warm baths with friction are necessary to promote free action of the skin, but great care must be exercised after their use to avoid chilling. In the early stages of chronic interstitial nephritis an occasional Turkish bath is often very advantageous. The hot-air bath, vapor bath, or hot pack may be used at home once or twice a week, or oftener if there is much edema, or if uremia threaten. Cold bathing should be interdicted. The bowels should be kept active by an occasional saline aperient. A great deal depends upon diet. No hard-and-fast rules, however, can be laid down, each case being a study in itself. When the symptoms are quiescent, a simple nourishing diet comprising a moderate quantity only of nitrogenous matter, may be allowed, its effect on the urine being carefully watched. Green vegetables, potatoes, farinaceous food, and ripe fruits usually agree best, but a certain amount of animal food in the form of eggs, oysters, fish, and mutton, or other tender meats, is often well borne. Indeed, considerable caution must be exercised lest in our zeal to relieve the kidneys we reduce the strength of the patient by adhering too strictly to a non-nitrogenous diet. The common dogma that red meats are more harmful than white meats in chronic Bright's disease receives no support from the observations of von Noorden, Offer and Rosenquist, or Kauffmann and Mohr, who conclude that the various forms of meats are suitable in such cases purely in proportion to their digestibility. Water-drinking between meals is generally beneficial, and a mild alkaline mineral water, such as Vichy or Vals, may be taken to the extent of a pint (0.5 L.) or more a day. In many cases of chronic parenchymatous nephritis, especially when there is decided edema or a tendency to uremia, an absolute milk diet is most suitable. The patient should take at stated intervals such quantities of milk as will aggregate in the twenty-four hours from 2–4 quarts (2.0–4.0 L.). The milk should not be skimmed, but diluted with carbonated water or an alkaline mineral water.

In chronic interstitial nephritis an absolute milk diet is not always successful. Indeed, as von Noorden has pointed out, much good sometimes results from restricting in this form of nephritis the fluids to between 40 and 50 ounces (1200.0–

1500.0 c.c.), especially when there is dilatation of the heart and a tendency to cardiac asthma.

**Medicinal Treatment.**—We possess no remedies that are directly curative. In the interstitial form potassium iodid (1–5 gr.—0.06–0.3 gm.) or bichlorid of mercury ($\frac{1}{80}$—$\frac{1}{40}$ gr.—0.001–0.0016 gm.), two or three times a day, occasionally seems to have a beneficial effect, but in the large majority of cases these remedies are of no avail. Mild hematinics, like Basham's mixture, are often useful, especially in chronic parenchymatous nephritis, but only small doses should be used. The indiscriminate use of iron in chronic interstitial nephritis, as Tyson has shown, is often productive of harm. It is indicated only when there is evident anemia. Strychnin and the simple bitters are valuable adjuvants to iron in many cases. Late in the disease, when the urine becomes scanty and dropsy appears, hydragogue diuretics are called for, although they often prove disappointing. Those most likely to succeed are digitalis, the vegetable salts of potassium, caffein, and theobromin.

**Operative Treatment.**—Edebohls claims that chronic Bright's disease in its early stages is curable or susceptible to amelioration by renal decapsulation. The good results of the operation are attributed to the development of numerous blood-vessels, particularly arteries, in the firm adhesions between the kidneys and the surrounding tissues, the blood stream passing from the latter to the kidneys. This, it is thought, leads to gradual absorption of the intertubular inflammatory products, thus freeing the tubules and glomeruli from compression, and permitting the re-establishment of a normal circulation, with regenerative production of new epithelium capable of carrying on the secretory function. Edebohl's operation has not been employed extensively enough as yet to warrant positive conclusions as to its therapeutic value. That it has resulted in marked improvement in some cases must be admitted; that actual cure has ever been effected by it, however, is extremely doubtful.

**Treatment of Special Symptoms.**—For the *anemia* the most effectual measures have already been enumerated (see p. 618).

*Dropsy.*—Hydragogue cathartics and hot-air baths are chiefly to be relied upon for abstracting the water from the body. Among the former, Epsom salt, compound jalap powder, and elaterium are the most serviceable. Injections of pilocarpin may also prove useful, but they should be withheld when the

heart is weak or when there is any tendency to pulmonary edema. Diuretics are sometimes efficacious. The best are digitalis, the vegetable salts of potassium (bitartrate or acetate), caffein, theocin, and theobromin. The dechloridation treatment of Widal and Javal is at times very successful and is well worth trying. It consists in giving food with a minimum amount of salt. When dropsy is extreme and does not yield to the usual remedies, operative measures may be required (see p. 617).

*High Blood-pressure.*—A certain increase in the arterial tension is necessary. It compensates for the renal inadequacy. When, however, the tension in the vessels becomes excessive and gives rise to headache, vertigo, palpitation, and dyspnea, it should be reduced by saline laxatives, warm baths, and the administration of nitroglycerin ($\frac{1}{100}$ gr.—0.00065 gm.—three times a day, increased if necessary until the desired effect is accomplished).

*Heart-failure with low arterial tension* will require the use of such stimulants as digitalis, strychnin, caffein, and alcohol.

*Asthma* should be treated as a manifestation of uremia. Nitrite of amyl, nitroglycerin, or ethyl nitrite affords some relief. When there is pulmonary congestion or edema, dry or wet cupping is often useful.

*Insomnia* may be caused by the retention in the blood of excrementitious matter, or may be due to high arterial tension. In the first case a milk diet and the administration of eliminants are called for; in the second, vasodilators (nitroglycerin or erythrol tetranitrate) will be helpful. When the insomnia is sufficiently severe to demand the use of hypnotics, bromids, veronal, chloral, paraldelyd, and trional may be tried in the order named. Opium should be avoided.

*Headache* is best treated by cold to the head, and the administration of saline purges and caffein (2–3 gr.—0.13–0.2 gm.) or nitroglycerin (1–2 min.—0.06–0.12 c.c.).

*Vomiting.*—When vomiting is persistent it is best to withhold food entirely for a time, allowing carbonated water or cracked ice only by the mouth. Sinapisms over the epigastrium sometimes afford relief. Such gastric sedatives as diluted hydrocyanic acid, bismuth subnitrate, cocain, and oxalate of cerium are worthy of trial.

*Diarrhea* should not be checked too quickly. When treatment is desirable mild astringents and intestinal antiseptics may be given. Opium should be used with extreme caution, if at all, not only in this but in all other complications of chronic nephritis in which sedatives are indicated.

## NEPHROLITHIASIS.

Medical treatment should be given a thorough trial in all cases of suspected renal calculus. It is doubtful whether stones once formed in the pelvis of the kidney can ever be dissolved, especially if they have already attained a considerable size, but much can be accomplished by internal remedies in preventing the formation of fresh deposits and in mechanically washing down into the bladder small concretions.

As uric-acid calculi are by far the commonest, efforts should be directed toward lessening the formation of uric acid and preventing its precipitation in the urinary passages. The patient should use only those articles of food which experience has shown to be most easily digested. The foods most likely to disagree are concentrated soups, hashes, croquettes, pastry, sweets, acid fruits, malt liquors, heavy wines, and all articles rich in nucleins, like the internal organs and young germinating plants. The quantity as well as the character of the food must be regulated. No more should be eaten than is absolutely necessary to maintain normal nutrition. Too long an interval should not be allowed to elapse between meals.

Gentle exercise in the open air and hydrotherapy are to be recommended since they favorably affect the underlying diathesis.

Much benefit accrues from abundant water-drinking between meals. This not only favors the expulsion of small concretions from the kidney, but by diluting the urine it also tends to prevent the precipitation of uric acid. Alkaline mineral waters, like Carlsbad, Vichy, Vals, and Buffalo and Londonderry lithia waters have been extensively employed, but they are no more efficacious than plain water which has been rendered alkaline by the addition of potassium citrate, ½–1 dr. (2.0–4.0 gm.) to the quart (1.0 L.), or of potassium bicarbonate 40 grains (2.5 gm.), and lithium citrate, 20 grains (1.3 gm.), to the quart. About a quart of such water should be consumed as a rule, in the twenty-four hours. In mild cases a single copious draught at bedtime may suffice to prevent recurrence of colicky pains. Some care is necessary not to allow the urine to become too alkaline, since this may lead to a deposition of phosphates about the uric-acid stone.

Among special remedies brought forward as solvents of uric acid (see p. 243) may be mentioned piperazin, lycetol, lysidin, piperidin tartrate, and urosin. While some authors claim to have seen beneficial effects follow the use of these drugs, the

majority of unprejudiced observers are sceptical as to their merits.

Recently Croftan has recommended calcium carbonate (15–20 gr.—1.0–1.3 gm.—thrice daily), which was first advocated by Von Noorden. The theory is that calcium, owing to its great affinity for phosphoric acid, unites with this acid in the blood to form calcium phosphate, which is subsequently eliminated in great part through the bowel, thus ridding the urine of mono-sodium phosphate, a precipitant of uric acid, while leaving in the urine di-sodium phosphate, an active solvent of uric acid.

*Phosphatic Calculi.*—Since phosphatic calculi can be deposited only from alkaline urine the indication is to render the urine acid, a task often difficult of accomplishment. Instead of a vegetable diet, one composed largely of readily digestible proteids should be ordered. Among special remedies recommended for the purpose of acidifying the urine may be mentioned benzoic and boric acids. From 5–15 gr. (0.3–1.0 gm.) of either of these drugs may be given in capsule, three to four times a day. Unfortunately, the continued use of these acids is prone to cause indigestion, an effect which detracts materially from their value. As in the case of uric-acid concretions, the copious ingestion of plain or distilled water is to be encouraged in order to prevent concentration of the urine.

*Oxalate-of-lime Calculi.*—As there is reason to believe that oxalates are formed under conditions very similar to those which give rise to an excess of uric acid, what has been said concerning the treatment of the uric-acid diathesis applies equally to that of the oxalate of lime.

**Renal Colic.**—The indications are to relieve the pain and to relax the spasm. This is best accomplished by hypodermic injections of morphin and atropin, coupled with hot baths or local applications—hot poultices or fomentations. If the pain is extreme it may be desirable to administer chloroform. Simple diluents should be given freely. In mild attacks full doses of phenacetin or antipyrin, with an abundant supply of hot drinks, may suffice.

**Surgical Treatment.**—In a certain number of cases surgical intervention affords the only hope of permanent relief. Operation is urgently demanded when the attacks of renal colic occur with such frequency as to prove disabling, when there are evidences of severe pyelitis, and when there is reason to believe that the calculus is impacted in the ureter. Unless there be pyonephrosis, nephrolithotomy is the operation to be

recommended, as it is attended with much less risk than that of nephrotomy or nephrectomy. The mortality in 82 cases of nephrolithotomy for non-suppurative nephrolithiasis was 2.4 per cent. (Newman and Legue). The average mortality in suppurative cases is not less than 15 per cent. The low mortality of early operation contrasted with the high mortality of late operation, when the kidney structure has been seriously damaged, is a strong argument for early interference.

## DISEASES OF THE NERVOUS SYSTEM.

### ACUTE CEREBRAL LEPTOMENINGITIS.

The treatment should be conducted on the same lines as that of cerebrospinal fever (see p. 515). When middle-ear disease is the exciting factor, and the symptoms can be definitely localized, operation may be justifiable. Several writers have recently spoken favorably of frequently repeated warm baths, as originally recommended by Aufrecht in 1894, combined with lumbar puncture (see p. 507).

### CEREBRAL HEMORRHAGE.

**Prophylaxis.**—Patients predisposed to apoplexy should lead a quiet life, one as free as possible from mental and physical excitement. The food should be nutritious and easily digestible. Moderation in eating and regularity of meals are matters of prime importance. Alcohol should be interdicted. The bowels should be made to act daily, a mild aperient being given if necessary.

**The Attack.**—If the patient be seen early, he should be placed in a reclining position with the head and shoulders well elevated. Bowles advocates turning the patient over on the paralyzed side to lessen the stertor. An ice-bag should be applied to the head, and warm bottles to the feet. The bowels should be promptly emptied by an enema, and later by a drastic cathartic, preferably croton oil, one or two drops of which, mixed with a little sweet oil, may be placed upon the tongue.

In sthenic cases, when the face is congested and the pulse is slow and full, venesection to the amount of ½–1 pint (250.0–500.0 c.c.) is indicated. The abstraction of blood cannot undo damage that is already done, but by lessening the supply of blood to the brain it may serve to arrest bleeding that is still in progress or to prevent an early recurrence. If venesection does not seem justifiable, lowering of the arterial pressure may be effected by the administration of aconite or veratrum viride

When the heart's action is feeble and the face is blanched, stimulants like alcohol, ether, and camphor may be given very cautiously, although it is unlikely that they will be of much avail.

When the respiration fails before the circulation, artificial respiration may be practised with advantage. In a case cited by H. C. Wood, in which final recovery was complete, it was necessary for nearly two days for an attendant to hold forward the jaw and tongue by raising the ramus of the jaw upward and forward, in order to prevent mechanical asphyxia.

Thorough cleanliness, bathing with alcohol, frequent change of position, and the avoidance of roughnesses in the bed are necessary in order to prevent the development of bed-sores. Since blisters are produced more readily than in health, special care should be taken in using hot applications of any kind.

Retention of urine is apt to occur, and if it does the patient must be catheterized.

**After the Seizure.**—Absolute rest in bed must be maintained. Even in the mildest cases the patient should not be allowed to leave his bed for two or three weeks, and during this time the diet should be light and unstimulating. The ice-cap should still be kept upon the head. Aconite in small doses with sweet spirits of nitre is often useful in subduing the fever of reaction and in decreasing arterial tension. For restlessness and wakefulness, small doses of a bromid or of chloral may be given. Potassium iodid is often prescribed with the hope that it may aid in absorbing the clot, but it is of doubtful utility, and moreover, it is very prone to disturb the digestion.

After the acute symptoms have entirely disappeared, which will rarely be earlier than ten days or two weeks after the attack, massage should be systematically practised. It often contributes much to the restoration of power, or when this is impossible, to the prevention of contractures. After the lapse of three or four weeks, triweekly applications of the faradic current may be of service (see p. 481). Strychnin is often given at this time, but it probably exerts no other influence than that of a general tonic. In some cases warm saline baths (90°–95° F.—32°–35° C.), combined with passive movements, prove useful adjuvants.

## LOCOMOTOR ATAXIA.

Rest is an important factor in the treatment. The sense of fatigue being impaired in this disease, patients are very prone to overtax their strength. Erb advises that the patient should live as if he were an old man, quietly, regularly, and with no excitements. In many cases it is well to begin treatment with

absolute rest in bed for several weeks. Mental fatigue should also be avoided. Sexual excesses are exceedingly injurious. The diet should be nutritious and easily digestible. Alcohol and tobacco should be used sparingly, if at all.

Patients suffering from locomotor ataxia should wear flannel next to the skin, and should avoid exposure to wet and cold, as well as sudden alterations of temperature. When practicable a change to a warm, equable climate during the winter months may be recommended with advantage.

Massage affords a valuable means of securing the benefits of exercise without the expenditure of energy.

Systematic re-education of co-ordinating movements, as originally recommended by Frenkel, has been found a most effective remedy for the ataxia (see p. 486). Even in advanced cases, in which there is marked disturbance of sensation, this method of treatment is not without benefit, and the improvement may last for years if the disease is stationary or only slowly progressive. The treatment by suspension, introduced by Motschukowski, and that by nerve-stretching, proposed by Langenbuch, have become obsolete.

Tepid baths of 80°–85° F. (26.5°–29.5° C.) are sometimes of distinct service. On the other hand, hot baths, vapor baths, and cold baths are usually harmful, and often provoke lancinating pains. Various natural springs enjoy a special reputation, the most popular being the Hot Springs of Arkansas, those of Virginia, and those of Los Vegas, New Mexico, in this country, and the thermal baths at Rehme, Nauheim, and Aix-la-Chapelle in Europe. Patients in whom the disease is far advanced should, of course, be spared the cost and discomforts attendant upon a long journey. According to Frenkel, treatment by baths should be forbidden while the exercise treatment is being used. While electricity is undoubtedly of service in relieving certain sensory disorders of ataxia, there is no ground for believing that it can affect in the slightest degree the morbid process in the spinal cord.

Mercury and iodids should be given a thorough trial in all cases in which syphilis is suspected. It must be admitted, however, that antisyphilitic treatment rarely accomplishes any good unless the infection by syphilis has been quite recent. Most of the cases of tabes that have recovered under mercury have been examples of peripheral neuritis.

Among numerous special remedies which have been in vogue at various times, but which are of very doubtful utility, may be mentioned silver nitrate, ergot, calabar bean, strychnin, belladonna, phosphorus, chlorid of gold, arsenic, corrosive sublimate, and spermin.

**Treatment of Special Symptoms.**—When the pains are severe the most potent remedial measure is absolute rest in bed. Light touches of the actual cautery or sinapisms over the root of the nerve supplying the affected part often afford relief. Deep massage is sometimes of service. Mitchell has found the alternate application of ice and hot water useful. Flannel bandages applied firmly from the toes up to the middle third of the thigh sometimes do much good. A snugly fitting abdominal binder may also be used to lessen girdle pain. Electricity in the form of the faradic brush, static spark, or stabile galvanic anode, is worthy of a trial.

The most generally useful anodynes are phenacetin, antipyrin, and acetanilid. Cannabis indica occasionally succeeds. According to Osler, the prolonged use of nitroglycerin, given in increasing doses until the physiologic effect is produced, is of great service in allaying pains and diminishing the frequency of crises in all cases of tabes in which there is increased arterial tension. In many cases recourse must be had to morphin, but its use should be deferred as long as possible.

*Gastric Crisis* may require the withholding of food by the mouth for a time, the patient being sustained by nutritive enemata. Lavage is often beneficial. The application of sinapisms over the epigastrium may do good. Morphin hypodermically may be necessary.

*Laryngeal crisis* may be relieved by local applications of cocain, inhalations of chloroform or amyl nitrite, or the administration of anodynes.

*Numbness* and *paresthesia* often yield for a time to local applications of faradism given with the wire brush.

*Vesical and rectal tenesmus* may be relieved by suppositories of opium with belladonna, or applications of cocain. Mitchell has found faradism of great service (see p. 482).

*Obstinate priapism* is best treated by tepid hip-baths or general baths and the administration of anaphrodisiacs—bromids, monobromated camphor, or hyoscin. Sexual intercourse should be avoided.

*Vesical weakness* should receive the most careful attention. The bladder must be thoroughly emptied, if need be by catheterization. On the first appearance of cystitis the bladder should be thoroughly washed out with weak antiseptic solutions.

## MYELITIS.

**Acute Myelitis.**—No time should be lost in placing the patient at absolute rest. In severe cases a water-bed should be employed. Such antiphlogistic measures as cupping, blis-

tering, and cauterizing are of doubtful utility. Cold, however, in the form of Chapman's ice-bags, may be applied to the spine. Daily warm baths (90° F.—32.2° C.) lasting from ten to fifteen minutes are useful. Drugs are of little value. Ergot is often used for the purpose of constricting the spinal vessels and thus limiting the local congestion.

Every precaution must be taken against the development of bed-sores. Frequent change of the patient's position, absolute cleanliness of the parts subjected to pressure, and bathing with alcohol and water will do much toward obviating this complication. If bed-sores are already formed they should be treated thoroughly according to surgical principles. Retention of urine must be met by systematic catheterization under the most strict antiseptic precautions. When there is constant incontinence a carefully adjusted urinal should be employed.

Any tendency to cystitis will call for daily irrigation of the bladder with a solution of boric acid or other mild antiseptic solution. If recovery with partial paralysis result, massage and electricity may aid in bringing back some of the lost power.

**Chronic Myelitis.**—Hygienic measures are far more important than drugs. Prolonged rest is desirable. Residence in a warm, equable climate is often serviceable. Daily warm baths are grateful. Counterirritation in the form of light touches of the actual cautery is useful in relieving pain, but it does not seem to exert any direct influence on the progress of the disease. When there is reason to suspect the existence of syphilis, mercury and iodids should be given a thorough trial. Tonics are often indicated. Massage, passive movements, and electricity are useful in maintaining the nutrition of the affected muscles. Early measures should be taken to prevent the formation of bed-sores and the development of cystitis.

### POLIOMYELITIS.

**Acute Poliomyelitis.**—In the acute stage absolute rest in bed is requisite. Not the slightest benefit accrues from the application of wet cups or leeches to the spine, or from any other form of counterirritation. Mild mercurial laxatives and febrifuge medicines may be used with some advantage. Ergot is often prescribed for the purpose of diminishing congestion of the ventral horns, but it is of very doubtful utility. The affected limbs should be thoroughly wrapped in cotton-wool to maintain warmth and circulation.

After the acute symptoms have subsided, which will probably be at the end of two or three weeks, an effort should be made to promote the restoration of the paralyzed muscles.

General hygienic measures must not be neglected. Nutritious food and fresh air are valuable aids. Little is to be expected from internal medication. Tonics like iron and cod-liver oil are sometimes of service. Strychnin seems to do some good. Massage in the form of effleurage and kneading is the most useful measure. It should be practised for ten or fifteen minutes daily for several months, or even for a year. Local bathing with shampooing may also be employed with benefit.

Electricity, while less efficacious than massage, is worthy of a thorough trial. As faradism generally fails to elicit any response, recourse must be had to an interrupted galvanic current. One pole (cathode) may be placed over an indifferent point, such as the spine, while the other (anode) is slowly stroked over the affected muscles. The weakest current that will cause contraction should be used. The treatment should be given for ten minutes, three or four times weekly, and should be kept up, if necessary, for several months. If after six or eight weeks of electric treatment there is no demonstrable improvement the outlook is very gloomy. Still, even here a successful issue is not impossible. The treatment of the later stages of infantile paralysis is chiefly surgical, and has for its object the prevention or correction of deformities.

**Chronic Poliomyelitis.**—There is practically no remedy for this disease. Massage, hydrotherapy, and electricity have seemed to be of some avail, but no permanent good has been achieved by these or other measures. Gowers has spoken favorably of strychnin and arsenic. In cases with a history of syphilis, mercury and iodids should be tried.

## NEURITIS.

Careful search should be made for the exciting cause—rheumatism, gout, syphilis, alcoholism, metallic poisoning, mechanical injury, or neighboring inflammation—with the view of removing it if possible. Absolute rest is imperative. When the nerves of the limbs are affected the muscles should be immobilized by means of splints and bandages, as in the treatment of fracture.

In acute cases, irrespective of the cause, counterirritation is of service. This may be accomplished by applying linear blisters or painting iodin along the course of the inflamed nerve. In mild forms of the disease hot applications of lead-water and laudanum will suffice. Occasionally cold in the form of an ice-bag proves more grateful than fomentations. Coal-tar derivatives (phenacetin, antipyrin) and salicylates are useful in

relieving pain. Such combinations as the following are often efficacious:

℞ Acetphenetidini, ʒiss (6.0 gm.);
Salol, ʒj (4.0 gm.).—M.
Fiant chartulæ, No. xii.
Sig.—One every three or four hours.

℞ Codeinæ sulphatis, gr. iij (0.2 gm.);
Acetanilidi,
Salophen, āā ʒj (4.0 gm.).—M.
Fiant chartulæ, No. xii.
Sig.—One every three or four hours.

When the pain is very intense subcutaneous injections of morphin must be used.

As soon as the pain and tenderness have distinctly lessened warm baths and gentle friction may be employed. In localized neuritis inunctions with mercury and belladonna ointment may also be used with great advantage in this stage. When the symptoms of irritation have completely subsided massage and electricity should be resorted to for the purpose of restoring the functions of the nerves and muscles. The faradic current should be used if the muscles respond to it. In the more severe cases in which faradic excitability is lost, labile and interrupted galvanic currents should be applied with the pole that produces the best contractions. Even with extreme atrophy these measures sometimes succeed in effecting decided improvement. Passive movements and extension will be required to overcome contractures and deformity.

Tonics, especially strychnin and arsenic, are often of service in the later stages of the disease.

**Sciatica.**—The first indication is to remove the cause. This may be some affection of the pelvic organs requiring surgical intervention, or it may be rheumatism, gout, syphilis, or metallic poisoning, and then general as well as local treatment must be resorted to.

In acute cases rest in bed is essential. Free evacuation of the bowels should be secured in order to deplete the pelvic veins. When there is a definite history of rheumatism or the attack has been induced by cold, salicylates should be given in full doses. When there is reason to suspect syphilis iodids should be given a fair trial. Irrespective of the cause, phenacetin or antipyrin may be useful in relieving pain. Counter-irritation often affords much relief. When the pain is very severe this is best accomplished by means of small blisters or light touches of the actual cautery applied over the points of greatest tenderness. In some cases acupuncture (see p. 438) acts very satisfactorily. In milder cases the Scottish douche—

in which a stream of warm water of gradually increasing temperature is directed on the course of the nerve until the pain subsides, when it is suddenly changed for a cold jet—is an efficient remedy. Agonizing pain must be relieved by injections of cocain (¼ gr.—0.016 gm.), chloroform (5–10 min.—0.3–0.6 c.c.), guaiacol (2–3 min.—0.1–0.2 c.c.), or morphin (⅛–¼ gr.—0.008–0.016 gm.), made deeply and as near to the nerve as possible. Morphin should be withheld as long as possible on account of the grave danger of inducing the morphin habit. In some cases deep injections of distilled water act remarkably well. Massage is indicated only when the acute symptoms have subsided, and should then not be too energetic. Electricity is rarely needed, even if there has been much wasting. In obstinate cases of sciatica the following treatment, outlined by S. Weir Mitchell, often acts most happily: A long flannel bandage is firmly applied from the foot to the groin, and renewed twice a day. The leg is slightly bent at the knee and kept nearly straight at the thigh, and in this position secured to a light side splint extending from the axilla to the ankle by a few turns of a bandage. Care is of course taken to prevent pressure on the heel. After a few days the joint-angles are slightly changed at each dressing. Still later passive motion is carefully employed, and after about three or four weeks the splint is removed during the day and replaced at night. Finally, guided as to time by the presence or absence of pain, the splint is removed altogether, the bandage being kept on somewhat longer, and gentle massage being used between each application after pain has quite disappeared. A full diet, cod-liver oil, and iron as needed, are given during the whole period. Any points of persistent pain that may be left at the close of the treatment are treated by counterirritants, preferably by small blisters or light touches of a white-hot Paquelin button. The patient must not sit at all during the first week after getting up, but must stand or walk, and that only with crutches. He may be upright or lying on a bed, but not seated.

Among other measures which have proved successful in individual cases may be mentioned hydrotherapy in the form of warm baths or mud baths, galvanism (5–7 milliampères), the continued application of ice-bags, and nerve-stretching, either by forcibly flexing the thigh upon the body or by cutting down upon the nerve itself.

## NEURALGIA.

An effort should be made to adapt the treatment to the etiology of the disease. Causes of reflex irritation—carious

teeth, errors of refraction, nasal obstruction, neoplasms, and cicatrices—should be sought for, and when found removed if possible. When the disease is associated with anemia, iron and arsenic will be indicated. If there is any suspicion of syphilis, mercury and iodids should be tried. When a malarial element is present, quinin may effect a cure. When rheumatism is an etiologic factor, salicylates and alkalis may prove beneficial. In gouty subjects much may be expected from regulation of diet, systematic exercise, and the administration of alkalis. The occupation of the patient, a blue line on the gums, and lead in the urine may lead to the recognition of plumbism, and in this case the iodids will be indispensable.

All influences that tend to induce a morbid excitability of the nerves or of their centers—mental or physical fatigue, emotional excitement, sexual excess, over-indulgence in tobacco, tea, coffee or alcohol—should be removed so far as possible.

In every case of neuralgia we must endeavor to improve the general nutrition, which is almost always disturbed. The measures to be employed for this purpose include an abundance of fresh air, proper food, regular hours, adequate protection from the vicissitudes of weather, systematic exercise, frequent bathing with friction, and the use of such tonics as iron, arsenic, cod-liver oil, and hypophosphites. If the patient cannot take active exercise rest with massage should be substituted. Neuralgia in neurasthenic patients is sometimes successfully managed by a modified Weir Mitchell treatment. A change of residence to a warm dry climate has been known to effect a complete cure.

**Special Treatment.**—The list of agents recommended for the cure of neuralgia is bewildering. "Numerous are the means at our disposal for combating the disease, quite as numerous are the patients who, after hundreds of unsuccessful trials, give up all medicines and all physicians" (Hirt). Among the internal remedies most worthy of confidence may be mentioned the coal-tar analgesics (phenacetin, antipyrin, and acetanilid), morphin, bromids, cannabis indica, croton chloral, gelsemium, caffein, nitroglycerin, and salicylates. The coal-tar analgesics are the most generally useful anodynes for the attack. Their action, moreover, is prompt. From 5–8 gr. (0.3–0.5 gm.) of one of these drugs may be given every two or three hours, according to the intensity of the pain. The fact must be borne in mind that these agents when used continuously not only lose in potency, but may also unfavorably influence general nutrition. Morphin is undoubtedly the most certain means we possess of affording temporary relief, but on

account of the danger of inducing the opium habit it should be employed only as a last resort. Under no circumstances should the patient himself be allowed to use the hypodermic syringe. In mild attacks bromids in large doses sometimes succeed. Combinations of a bromid with phenacetin or antipyrin may often be prescribed advantageously. Cannabis indica is especially valuable in migraine, in which affection it may be given in doses of from ¼–½ gr. (0.016–0.03 gm.). Croton chloral, in doses of from 5–10 gr. (0.3–0.65 gm.), and tincture of gelsemium, in doses of 10 min. (0.6 c.c.) or more, are occasionally serviceable in trifacial neuralgia. Caffein, in doses of from 3–5 gr. (0.2–0.3 gm.), is often efficacious. Combinations of caffein with phenacetin or with bromids in many cases do more good than single drugs. Nitroglycerin, in doses of from $\frac{1}{150}$–$\frac{1}{60}$ gr. (0.0004–0.0012 gm.), has been highly recommended in migraine-like attacks with signs of vasoconconstriction. Neuralgia brought on by exposure to cold and wet is favorably influenced by the salicylates. In such the following combination will be found of value:

℞ Acetphenetidini,
Salophen, aa ʒiss (6.0 gm.);
Codeinæ sulphatis, gr. iij (0.2 gm.). M.
Fiant chartulæ, No. xii.
Sig.—One powder every two or three hours.

Dana and others have spoken favorably of strychnin in heroic doses in tic douloreux (see p. 145).

**Local Treatment.**—Heat, dry or moist, may be applied for its soothing effect. In some cases cold in the form of an ice-bag is more grateful. Menthol and chloral camphor are useful in neuralgia of superficial nerves when the pain is slight. Congelation of the skin by ethyl chlorid occasionally has a good effect. Acupuncture and aquapuncture are effective, but are not suitable for use about the face. In obstinate cases active counterirritation by means of blisters or the thermocautery will be found a potent remedy. In trifacial neuralgia the blisters may be applied behind the ear. Even when the pain is very intense injections of cocain (⅛–¼ gr.—0.008–0.016 gm.) upon the nerve often bring relief, but the grave danger of establishing a habit must never be forgotten. Cocain may also be introduced through the unbroken skin by cataphoric action (see p. 482). Electricity is sometimes of service. Bennett and Hammerschlag have each treated 9 cases of trifacial neuralgia by the injection of osmic acid into the nerve with good results. Schlösser, Oswalt, Kiliani, and others report favorably upon deep injections of alcohol. No matter what agent is employed,

however, treatment by injection rarely affords relief for more than a year or two.

Finally, when all other measures fail, recourse may be had to surgical interference. Nerve-stretching and nerve-section are the operations usually performed. Lasting benefit is rarely obtained from either operation, although excision is more reliable than stretching. In trifacial neuralgia removal of the Gasserian ganglion or division of its sensory root usually affords permanent relief. In the last few years the mortality of this procedure has been much reduced. In Horsley's series of 120 cases it was 3.3 per cent., and in 27 cases reported by Frazier it was 3.7 per cent.

## CHOREA.

Rest of body and mind is the most important factor in the treatment of the disease. No matter how slight the attack may be the child should be taken from school. In all except the mildest cases rest in bed in a quiet, well-ventilated room is essential. When the movements are so violent as to bring about contusions the bed should be padded or the child put in a hammock. It is almost always advisable to exclude the child's playmates, even his own brothers and sisters, from the sick-room. Excitement of all kinds should be proscribed.

Gentle massage may be of benefit, especially in poorly nourished children, but gymnastic exercises should be reserved for the period of convalescence. Daily warm baths (95° F.—35° C.) are often beneficial. In older children, and especially in neurotic cases, the wet-pack may be used with great advantage. As M. Allen Starr has pointed out, a change of air, especially a change to the seashore, is often of the utmost service in obstinate cases.

In all cases of chorea reflex irritation—ocular defects, adherent prepuce, etc.—should be carefully sought for, and when found removed if possible. On account of the tendency of chorea to recur, children who have once suffered from the disease should not be overtaxed in school, and should be guarded, as far as possible, from attacks of rheumatism.

**Medicinal Treatment.**—Arsenic is by far the most useful remedy. The dose should be gradually increased until physiologic effects are produced. In a child of five or six years we may give 3 min. (0.2 c.c.) of Fowler's solution three times a day, and increase the dose by a minim (0.06 c.c.) a day until physiologic effects are seen. These are puffiness about the eyes, nausea, griping pains or diarrhea. In many cases from 10–15 min. three times a day can be taken before untoward symptoms develop. When these occur the drug should be suspended for two or three days and then resumed at a dose

slightly less than the child was receiving when the phenomena of salivation appeared. Arsenic should always be given after meals, and well diluted. While taking large doses of arsenic the patient should be kept under close observation, as albuminuria, conjunctivitis, inflammatory diseases of the skin, or even multiple neuritis may develop independently of the usual untoward effects.

In the cases in which arsenic fails or is not well borne, cimicifuga may succeed. A dose of 10 min. (0.6 c.c.) of good fluid extract may be given three times after meals and gradually increased to ½ dr. (2.0 c.c.) or more. Antipyrin, in doses of from 30–60 gr. (2.0–4.0 gm.) a day, has been strongly advocated by Dujarden-Beaumetz, Legroux, Starr, Comby, and others, but when used so freely this drug may cause prostration, acute anemia, cyanosis, and hemoglobinuria. When symptoms of acute rheumatism are present salicylates are of service, otherwise they usually fail. When the movements are very violent and interfere with sleep, hyoscin hypodermically in doses of from $\frac{1}{200}$–$\frac{1}{100}$ of a gr. (0.0003–0.0006 gm.) twice daily, often acts most happily. If hyoscin fails recourse must be had to chloral, bromids, or morphin, but these drugs should not be used unless the symptoms are of great severity. Chloralamid and trional are reliable hypnotics.

Iron is often required to combat the marked anemia which is present in many cases.

**Chorea Insaniens.**—Powerful sedatives like hyoscin, chloral, and morphin are required to allay the violent excitability and jactitation. Inhalations of chloroform are sometimes useful. Stimulants are almost always required. When the patient is unable to swallow no time should be lost in resorting to forced feeding. Severe cases of chorea complicating pregnancy will call for the induction of premature labor.

## EPILEPSY.

Although in the vast majority of cases epilepsy is an incurable disease, yet much can often be done to lessen the frequency of the paroxysms. Hygienic treatment is of the utmost importance. Moderate exercise, both mental and physical, is beneficial. Idleness and seclusion have a baneful effect. Children should be kept at school, but competition and overstudy should be avoided. Home training must be carried on with the greatest care, much tact and firmness being required to prevent loss of self-control. Children who are particularly irascible are often much better trained in a special institution. Adults should follow, if possible, some light and

agreeable pursuit, preferably one which will permit them to spend the greater part of the day in the open air, and which will not add to the risk of physical injury should attacks come on without warning. The establishment of so-called epileptic colonies or farms, where patients can be employed in agricultural pursuits, has proved a great boon to many epileptics of the bread-winning class. In such institutions as are to be found at Biellefeld, Potsdam, and Stettin in Germany, at Zürich in Switzerland, at Chalfont St. Peter in England, and at Craig Colony in New York, large numbers of sane epileptics are able to support themselves under proper care and supervision.

The diet should be nutritious, but simple and readily digestible. As a rule a diet that is for the most part vegetable will be found to be best adapted to the patient's condition, but where the disease is associated with lowered vitality a fair amount of animal food should be permitted. Overloading of the stomach is a potent factor in precipitating attacks. The principal meal is best taken at midday, and full evening meals should be avoided. The assertion made by Richet and Toulouse that it is advantageous to reduce the sodium chlorid taken with food to a minimum—that is, to 2½–3 gm. a day—has been confirmed by several observers.

Tea, coffee, alcohol, and tobacco should be used very sparingly, if at all. The patient must be constantly warned against excesses of every kind. The digestive functions should be brought to the highest possible state of efficiency. The bowels must be regulated by diet, and, if necessary, by mild aperients. Liberal water-drinking, frequent bathing, followed by friction of the skin, light exercise in the open air, and other measures which favor elimination are to be recommended. General tonics, like iron, arsenic, and cod-liver oil, are sometimes required to combat anemia and malnutrition.

Although very few cases of epilepsy are purely reflex, local irritation—phimosis, adherent prepuce, worms, a foreign body in the nose or ear, and painful cicatrices—should be carefully sought for, and if found removed. Epileptic patients ought not to marry.

**Special Treatment.**—Among palliative remedies the bromids, originally recommended by Locock in 1853, hold the first place. The ammonium and sodium salts are generally preferable to the potassium salt, being less depressing and less irritating to the stomach. In cases in which the digestive tract is especially sensitive, or in which only a mild effect is desired the strontium salt may be selected with great advantage. A

combination of bromids sometimes acts more satisfactorily than a single bromid. The amount of the drug required varies with the severity of the case and the susceptibility of the individual, and must be determined experimentally in each case. The requisite daily dose usually ranges between 1 and 2 drams (4.0–8.0 gm.). The addition of one or two drops of Fowler's solution to each dose of bromid is useful in preventing the occurrence of acne. When the attacks occur at irregular intervals the bromid is best given in equal doses thrice daily after meals. When, however, some periodicity is manifested it is advisable to administer the drug in relation to the time of the attacks. Thus in nocturnal epilepsy a single large dose at bedtime may suffice. Again, in women, when the seizures occur only at the menstrual periods, active medication may be restricted to the week preceding each period. When the convulsions occur at long intervals and show no tendency to increase in frequency, it is better to dispense with special medication entirely and to rely upon hygienic and dietetic measures to lessen the excitability of the nerve-centers. In every case it is of the utmost importance to limit the dose of the bromids to the smallest possible amount that will control the seizures. Relief that comes only with saturation is generally dearly purchased.

Mention has already been made of the fact that the withdrawal of salt from the diet renders the patient more susceptible to the action of the bromids. The theory is that the tissues deprived of sodium chlorid more readily take up the bromids owing to the lack of other halogen bases in the dietary. Certain drugs, not very effective in themselves, are of service when combined with the bromids in that they lessen the amount of the latter required to control the convulsions. Antipyrin is one of the best of these auxiliary remedies. A daily dose of 10 gr. (0.6 gm.) not infrequently doubles the power of the bromids. Such a combination as that mentioned on page 114 proves valuable in many cases. Antipyrin may also be used in those cases in which the bromids, even in small doses, are not well borne. Acetanilid in daily doses of from 8–10 gr. (0.5–0.6 gm.) is sometimes substituted for antipyrin. In nocturnal epilepsy chloretone (5 gr.—0.3 gm.) or sulphonal (5–10 gr.—0.3–0.6 gm.) is often a useful adjuvant to the bromids. On account of its tendency to accumulate in the system and cause chronic poisoning, sulphonal should not be used continuously for longer periods than a week or ten days. Horse nettle (*solanum carolinense*) is another remedy which appears to increase the activity of the bromids. From ½–1 fl. dr. (2.0–

4.0 c.c.) of the fluid extract may be given thrice daily. When the circulation is weak a combination of digitalis or of adonis vernalis with the bromids, as recommended by Bechterew, will be found efficacious. In *petit mal* nitroglycerin in doses of $\frac{1}{100}$–$\frac{1}{20}$ gr. (0.0006–0.003 gm.) is sometimes of more service than the bromids.

Flechsig's treatment, which consists in giving large doses of opium for six weeks and then the bromids for two weeks (see p. 97), has been employed with some success in obstinate cases. It is not tolerated, however, by many patients and its employment necessitates a supervision that can be furnished only in fully equipped hospitals. Moreover it is not without danger.

**Surgical Treatment.**—Many attempts have been made to combat epilepsy by surgical treatment. Recourse has been had to castration, circumcision, clitoridectomy, tracheotomy, ligation of the carotids, ligation of the vertebral arteries, removal of the superior cervical sympathetic ganglia, and excision of certain cortical areas. Fortunately most of these measures are purely of historical interest. Trephining offers some hope of relief in certain cases of focal epilepsy, although it has to its credit less than 4 per cent. of recoveries. Clark[1] thus summarizes the present status of trephining: 1. Idiopathic epileptics with typical *grand mal* seizures should never be trephined. 2. Idiopathic epileptics in whom the seizures are of the Jacksonian type should be trephined only when infantile cerebral palsies can be excluded, and when the family and personal degeneracy is at a minimum. If operation is determined upon in such cases a very thorough removal of the epileptogenic area should be made; even then but a fraction of 1 per cent. recover from their epilepsy. Traumatic epileptics may be trephined when the injury is definitely proved and stands in direct causal relation and has existed not more than two years. The prognosis will then largely rest upon the degree of the neurotic predisposition present. The earlier trephining is resorted to after convulsions begin, the better the prognosis.

**Treatment of the Attack.**—When an aura is perceived it is often possible to arrest the paroxysm by the inhalation of amyl nitrite. Patients may provide themselves with this drug in the form of pearls which may be crushed in the handkerchief. When the attack is preceded by a local spasm forcible extension of the part sometimes succeeds in aborting it. If a sensory aura is felt in a limb the part may be firmly grasped or encircled with a tight ligature. The patient himself often learns by experience some method by which he can suppress

[1] *Medical Record*, Jan. 12, 1901.

seizures of which there is due warning. During the attack there is little to be done beyond protecting the patient from injuring himself. The head should be slightly raised, the clothes loosened, and a piece of cork or firm rubber pushed between the teeth. If necessary inhalations of amyl nitrite or chloroform may be used. In the *status epilepticus* the most reliable measures are inhalations of chloroform, ether, or amyl nitrite, hypodermic injections of hyoscin ($\frac{1}{100}$ gr.—0.0006 gm.) or of morphin ($\frac{1}{4}$ gr.—0.016 gm.), enemas of chloral (20–30 gr.—1.3–2.0 gm.), and the hot bath.

## NEURASTHENIA.

The treatment of neurasthenia must vary with the cause of the disease and the circumstances and idiosyncrasies of the patient. In every case an earnest effort should be made to determine the exciting cause and to remove it if possible. With this in mind the family history of the patient, his occupation, habits, and amusements, and the condition of his various organs must be carefully studied.

In the milder forms of the disease, especially when overwork has been the exciting factor, a month or two of rest with change of scene will often effect a cure. In such cases quiet travel, so planned that it will interest the patient without fatiguing him, is frequently attended with excellent results. A prolonged sea-voyage is sometimes very useful. In other cases the "wilderness cure" of S. Weir Mitchell may be recommended with advantage.

In the absence of any special gastric disturbance, the diet should be simple, readily digestible, and abundant. Tea, coffee, alcohol, and tobacco are better avoided. A tepid sponge bath in the morning, provided it be followed by a good reaction, is beneficial. The wet pack, sitz-bath, spinal douche, and Scottish douche are of service in individual cases.

The question of exercise is an important one. When the physical strength is fairly well maintained exercise in the open air, systematically carried out and cautiously increased, often yields admirable results, but the fact cannot be too strongly emphasized that any exertion pushed to the point of fatigue is distinctly harmful. In many cases it is advisable to substitute for active exercise passive movements and massage.

When there is marked muscular weakness as well as nervous inefficiency rest is imperative. This may be relative or absolute. In some cases the addition of from three to five hours to the time usually spent in bed, or a rest in bed of a

few hours during the day, will suffice. When, however, the symptoms are severe it will be necessary for the patient to give up all work for a period of from six to twelve weeks. In such cases much good accrues from the "rest cure" introduced by S. Weir Mitchell. This treatment includes not only rest but also full feeding, isolation, and artificial exercise. Of course, the details of the treatment must vary in each case, and only the outlines can be given here.

*Rest.*—In bad cases, for the first two or three weeks at least, rest must be absolute, the patient not being allowed to feed himself nor to leave the bed to pass urine or to empty the bowels. As to this point Mitchell says: "In some instances I have not permitted the patient to turn over in bed without aid, and this I have done because sometimes I think no motion desirable and because sometimes the moral influence of repose is of use." As improvement becomes manifest by a gain in weight, in muscular strength, and in nervous energy, some relaxation is permissible, and the patient may be allowed to sit up in bed to take meals and to indulge for a short time each day in reading or simple games. After four or five weeks he may be permitted to sit up in a chair for five or ten minutes a day, the time being gradually lengthened until at the end of a week or ten days he is up for from four to five hours. Active exercise is now cautiously introduced, and soon he is allowed to go out for a short walk or a drive. Finally, it is desirable that he should spend a week or two at the seashore or in the country before returning to his home.

*Feeding.*—In most cases the diet at first should be restricted to milk. From 4–5 oz. (120.0–150.0 c.c.) should be given every two hours, and this amount gradually increased until at the end of a week or ten days from 8–10 oz. (235.0–300.0 c.c.) are given every two hours. Little by little solid food may now be added until at the end of two or three weeks the patient is getting each day three full meals with from 3–4 pints (1.5–2.0 L.) of milk in the intervals. The solid food may include stale bread with butter, soft-boiled or poached eggs, thoroughly cooked cereals, oysters, sweet breads, broiled or roasted meats, green vegetables, cooked fruits, milk-puddings, and ice cream. The evening meal should be light.

*Isolation.*—This is an essential element in the treatment. No one should be permitted to see the patient except the medical attendant and the nurse. Even the writing and receiving of letters are to be forbidden.

The permanent return of the patient at the close of the treatment to his family and friends should be effected very

gradually. Any infringement of these rules is almost sure to mar the success of the treatment.

*Artificial Exercise.*—This is supplied in the form of massage and electricity. Through these measures the good effects of active exercise can be secured in a measure without the expenditure of any energy on the part of the patient. Massage should not be practised until the second or third day of the treatment, and even then it should be introduced very gradually. At first the séances should not last longer than a few minutes, but ultimately they may be increased to an hour a day. It is very important, as Dercum has urged, that the massage be performed by the nurse instead of another person with whom the patient would have to become acquainted.

Electricity, according to Mitchell, is the least necessary part of the treatment. It is, however, a useful adjuvant. Like the massage it should be introduced very gradually, otherwise it is likely to excite the patient and so prove harmful. A slowly interrupted faradic current is generally preferred. This should be applied once a day to each group of muscles in such strength as to elicit slight contractions.

Success in the rest treatment will depend quite as much upon the way in which the various measures are applied as upon the measures themselves. The fact must not be lost sight of that suggestion and discipline play a conspicuous part in the treatment; hence the importance of having all the details systematically and strictly carried out. It is always advisable to furnish a program indicating exactly what shall be done at each hour of the day. It is absolutely necessary that the nurse chosen to conduct the treatment shall be not only skilful and robust but also discrete, tactful, and agreeable to the patient. Finally, the more thoroughly the physician is able to inspire confidence in the patient and to convince him that his disease is not an incurable one, the more likely is he to effect a cure.

**Medicinal Treatment.**—Drugs are of little value except in meeting underlying conditions and in combating special symptoms. When there is anemia, iron and arsenic will be found useful. Small doses of strychnin are sometimes beneficial, but more often the drug is useless or actually harmful. Indigestion may be sufficiently severe to demand a modification of the dietetic treatment and the use of special remedies (see p. 555). Such drugs as asafetida, valerian, and sumbul are often helpful in allaying nervous irritability. The following pill, introduced by Goodell, may often be given with advantage:

℞ Arseni trioxidi, gr. ss (0.03 gm.);
Ferri sulphatis exsiccati,
Extracti sumbul, aa gr. xx (1.3 gm.);
Asafœtidæ, gr. xl (2.6 gm.).—M.
Fiant pilulæ, No. xx.
Sig.—One three or four times a day.

Every effort should be made to secure sleep by general measures—tepid baths, wet-packs, and gentle massage—before resorting to drugs. If a somnifacient becomes absolutely necessary, sodium or ammonium bromid, chloralamid, or trional may be given. Chloral and morphin should be withheld on account of the grave danger of inducing a drug habit. Severe headache may call for an occasional dose of phenacetin or of a bromid. Constipation can usually be controlled by diet and abdominal massage, but in some cases mild laxatives, like cascara sagrada, sodium phosphate, or the combination of aloin, belladonna, and strychnin will be required.

## HYSTERIA.

By proper mental, moral, and physical training much can be done to prevent the occurrence of hysteria in those who through inheritance are predisposed to the disease. Prophylactic treatment includes the inculcation of absolute obedience, self-restraint, and self-denial, a judicious education, suitable outdoor exercise, hygienic surroundings, temperate living, and the avoidance of all that tends to morbid emotionalism or sentimentalism.

In developed hysteria treatment must be directed both to the mind and the body, but especially to the former. To be successful the physician must be able to inspire absolute confidence and faith in the mind of the patient. She must be impressed repeatedly with the fact that her condition is a curable one, and that with her thorough co-operation restoration to health will certainly follow. To intimate that her symptoms are feigned or are wholly within her control is an egregious error. The physician's authority must be unquestioned and his instructions must be rigidly carried out. Want of firmness and of decision is a common cause of failure. Harsh measures are occasionally needed, but they should be adopted only after the most careful consideration. In many cases no method of treatment proves successful until the patient has been removed from her customary surroundings and separated from her sympathetic relatives and friends.

Suggestion is employed consciously or unconsciously in the treatment of hysteria by every successful physician. Without

it many of the remedies recognized as efficacious become wholly impotent. The cures which have been ascribed to the application of magnets and of various metals (metallotherapy) to the surface of the body seem to have been solely the result of suggestion. Complete hypnotism is by no means so generally useful as continuous suggestion. Certain symptoms—paralysis, aphonia, blindness, contracture, and anesthesia—are sometimes removed by a single hypnotic séance, but on the whole the action of hypnotism is disappointing. Moreover, in the event of failure it seems capable of still further lowering the will-power and of increasing the emotional excitability.

The physical condition of the patient must not be neglected. The general measures referred to under neurasthenia (see p. 639), such as hydrotherapy, systematic exercise in the open air, massage, and electricity, are equally applicable here. In grave cases of hysteria the treatment associated with the name of S. Weir Mitchell (see p. 640) often yields admirable results, but it is not suitable in every case, and considerable judgment must be exercised in the selection of proper subjects for it. Concerning this point Playfair writes: "The worse the case is the more easy and certain is the cure; and the only disappointments I have had have been in dubious, half-and-half cases."

Apart from their moral effect, drugs have but little influence upon hysteria. They must often be used, however, to meet underlying conditions and to combat special symptoms. Iron and arsenic are useful when there is anemia. Antispasmodics, like valerian, sumbul, asafetida, and camphor, are serviceable in allaying abnormal nervous irritability. Occasionally more powerful sedatives, like the bromids, phenacetin, and chloralamid, may be demanded, but the continuous use of such remedies is always to be condemned. Such drugs as morphin, alcohol, and chloral are distinctly dangerous.

When hysteria is complicated by local disease special treatment will be required, but no operation should ever be performed for the relief of nervous symptoms unless there exists an actual organic lesion.

**Treatment of Special Symptoms.**—*Convulsions.*—Isolation of the patient is imperative. Firm pressure over the ovarian region is often successful. The affusion of cold water over the face is useful. Inhalations of amyl nitrite, or even of chloroform, may be employed if necessary. Strong faradic currents applied to the spine are occasionally efficacious. *Anesthesia* is best treated by electricity, especially by the faradic wire-brush. Static electricity, owing to the profound mental impression which it produces, is also useful. *Hyperesthesia*

and *pain* often yield to the continuous or interrupted galvanic current. In *paralysis* the patient should be instructed how to regain by long-continued practise the use of the affected part. This process of re-education demands the exercise of great firmness and patience. Swedish movements, massage, and faradization are useful adjuvants. In *aphonia* the faradic current, applied by means of special electrodes, is the most reliable remedy. In *contractures* the most useful measures are massage, passive movements, and faradization. In obstinate cases it may be advisable to straighten the affected joint under an anesthetic and then apply a splint to the limb.

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## WEIGHTS AND MEASURES.

### APOTHECARIES' WEIGHT.

| Troy grains. | | Scruples. | | Drams. | | Troy ounces. | | Pound. |
|---|---|---|---|---|---|---|---|---|
| gr. 20 | = | ℈ 1 | | | | | | |
| 60 | = | 3 | = | ʒ 1 | | | | |
| 480 | = | 24 | = | 8 | = | ℥ 1 | | |
| 5760 | = | 288 | = | 96 | = | 12 | = | ℔ 1 |

### APOTHECARIES' (WINE) MEASURE.

| Minims. | | Fluidrams. | | Fluidounces. | | Pints. | | Gallon. |
|---|---|---|---|---|---|---|---|---|
| ♏ 60 | = | fʒ 1 | | | | | | |
| 480 | = | 8 | = | fȝ 1 | | | | |
| 7680 | = | 128 | = | 16 | = | O 1 | | |
| 61440 | = | 1024 | = | 128 | = | 8 | = | C. 1 |

### APPROXIMATE FLUID MEASURES.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Teaspoonful | = | fʒj. | | Tablespoonful | = | fʒiv. |
| Dessertspoonful | = | fʒij. | | Wineglassful | = | fȝij. |
| | | Teacupful | = | fȝiv. | | |

A *drop* is usually considered equivalent to a minim, but this is the case only with a drop of water under certain conditions. The size of the drop varies with the shape of the vessel from which the liquid is being dropped and with the character of the liquid. The broader and thicker the lip of the bottle the larger is the size of the drops. Again, the lighter the liquid and the greater its viscidity the larger is the size of the drops. Chloroform and bromin, being very heavy, each drop about 250 drops to the fluidram; tinctures, spirits, and fluid extracts drop from 130 to 150 drops to the fluidram; oils, except castor oil, from 105 to 140 drops to the fluidram; syrup, from 45 to 110 drops to the fluidram; and waters and solutions, from 60 to 90 drops to the fluidram.

## METRIC WEIGHTS.

| | | |
|---|---|---|
| 1 myriagram (Mg.) | = | 10,000 grams. |
| 1 kilogram (Kg.) | = | 1000 grams. |
| 1 hectogram (Hg.) | = | 100 grams. |
| 1 decagram (Dg.) | = | 10 grams. |
| 1 gram (Gm.) | = | weight of 1 cubic centimeter of water at 4° C. |
| 1 decigram (dg.) | = | tenth part of 1 gram, or 0.1 gram. |
| 1 centigram (Cg.) | = | hundredth part of 1 gram, or 0.01 gram. |
| 1 milligram (mg.) | = | thousandth part of 1 gram, or 0.001 gram. |

## METRIC MEASURES OF CAPACITY.

| | | |
|---|---|---|
| 1 myrialiter (Ml. 1) | = | 10 cubic meters, or the measure of 10 milliliters of water. |
| 1 kiloliter (Kl. 1) | = | 1 cubic meter, or the measure of 1 milliliter of water. |
| 1 hectoliter (Hl. 1) | = | 100 cubic decimeters, or the measure of 1 quintal of water. |
| 1 decaliter (Dl. 1) | = | 10 cubic decimeters, or the measure of 1 myriagram of water. |
| 1 liter (L.) | = | 1 cubic decimeter, or the measure of 1 kilogram of water. |
| 1 deciliter (dl. or L. .1) | = | 100 cubic centimeters, or the measure of 1 hectogram of water. |
| 1 centiliter (cl. or L. 01) | = | 10 cubic centimeters, or the measure of 1 decagram of water. |
| 1 milliliter (ml. or L. 001) | = | 1 cubic centimeter (c.c.), or the measure of 1 gram of water. |

## RULES FOR CONVERTING DRAMS AND GRAINS INTO THEIR METRIC EQUIVALENTS.

To convert drams into grams, *multiply* the number of drams by 3.9 grams, which is the number of grams in 1 dram. To convert grains into the corresponding metric quantity, *multiply* the number of grains by .065, which is the metric equivalent of 1 grain.

## RULES FOR CONVERTING METRIC QUANTITIES INTO DRAMS AND GRAINS.

To convert grams into drams, *divide* the number of grams by 3.9. To convert grams into grains, *divide* the number of grams by .065.

## EQUIVALENTS OF APOTHECARIES' IN METRIC WEIGHTS.

| Grain. | | Gram. | Grain. | | Gram. |
|---|---|---|---|---|---|
| $\frac{1}{200}$ | = | .000324 | $\frac{1}{2}$ | = | .0324 |
| $\frac{1}{150}$ | = | .00043 | 1 | = | .0648 |
| $\frac{1}{100}$ | = | .00064 | 2 | = | .1296 |
| $\frac{1}{75}$ | = | .00086 | 5 | = | .3240 |
| $\frac{1}{50}$ | = | .00129 | 8 | = | .5184 |
| $\frac{1}{40}$ | = | .00162 | 10 | = | .6480 |
| $\frac{1}{20}$ | = | .00324 | 15 | = | .9720 |
| $\frac{1}{10}$ | = | .00648 | 20 | = | 1.2960 |
| $\frac{1}{8}$ | = | .0108 | 30 | = | 1.9440 |
| $\frac{1}{4}$ | = | .0162 | 40 | = | 2.5920 |
| $\frac{1}{3}$ | = | .0216 | 60 | = | 3.888 |

## EQUIVALENTS OF APOTHECARIES' IN METRIC MEASURES.

| Minims. | | Cubic centimeters. | Fluidounces. | | Cubic centimeters |
|---|---|---|---|---|---|
| 1 | = | 0.061 | 1 | = | 29.57 |
| 2 | = | 0.123 | 2 | = | 59.14 |
| 3 | = | 0.185 | 3 | = | 89.00 |
| 5 | = | 0.308 | 4 | = | 118.29 |
| 7 | = | 0.431 | 6 | = | 177.42 |
| 10 | = | 0.616 | 10 | = | 295.73 |
| 15 | = | 0.924 | 12 | = | 355.00 |
| 20 | = | 1.23 | 16 | = | 473.17 |
| 30 | = | 1.84 | 20 | = | 591.50 |
| 40 | = | 2.46 | 24 | = | 710.00 |
| 60 | = | 3.7 | 32 | = | 946.35 |

## PERCENTAGE IN SOLUTIONS.

To estimate the quantity of a drug required to make a fluidounce or pint of a solution of a given percentage, *multiply* the weight of a fluidounce or a pint of the liquid to be used as the solvent by the percentage. Thus, in an ounce of a 10 per cent. *aqueous* solution of silver nitrate there are 45.5 grains.

455.7 grains (weight of a fluidounce of water) × 0.1 (percentage) = 45.5 grains.

In a pint of the same solution there are 729.1 grains.

7291 grains (weight of a pint of water) × 0.1 (percentage) = 729.1.

If a pint of a 1 : 1000, 1 : 100, or 1 : 40 solution be required, *divide* 7291 by 1000, 100, or 40, as the case may be, to determine the quantity of the drug. Thus, in a pint of corrosive sublimate solution (1 . 1000) there are 7.29 grains of the drug.

7291 grains ÷ 1000 = 7.29 grains.

To determine the weight of a fluidounce or pint of a liquid other than water, *multiply* 455.7 or 7291 by the specific gravity of the liquid, and the product will be the weight desired.

# INDEX.

[To obviate the inconveniences attending the use of two separate indexes—an Index of Diseases and an Index of Remedies—the author has employed but one general index. The name of each disease is printed in **bold-faced type**, and under it are grouped the remedies employed in the disease.]


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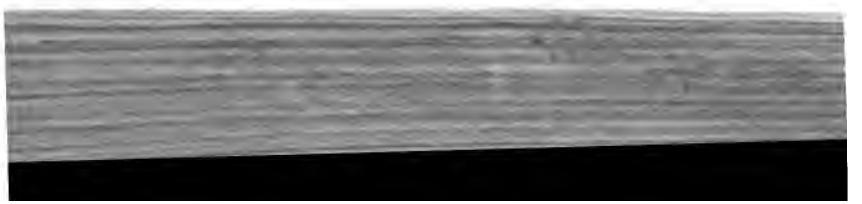

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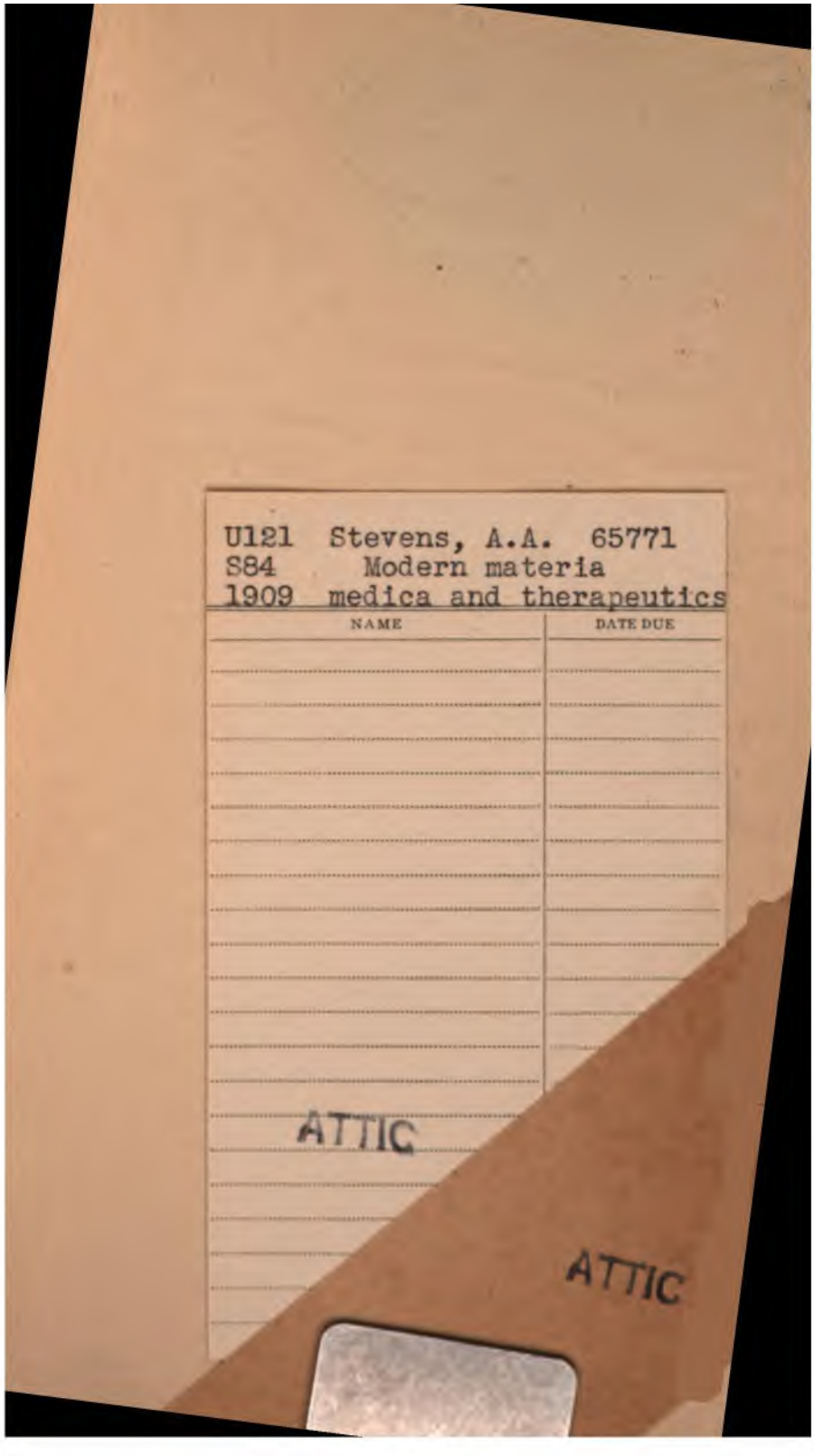
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